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JUL 5 1938

JULY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION AND THE DENTAL COSMOS

1938

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$5,000.00 Legacy to the Relief Fund
Pan-American Medical Cruise-Congress
COUNCIL ON DENTAL THERAPEUTICS
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The Journal of the American Dental Association and The Dental Cosmos. Vol. XXV, No. 7. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $5.00. Entered as second-class matter, March 25, 1937, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly.

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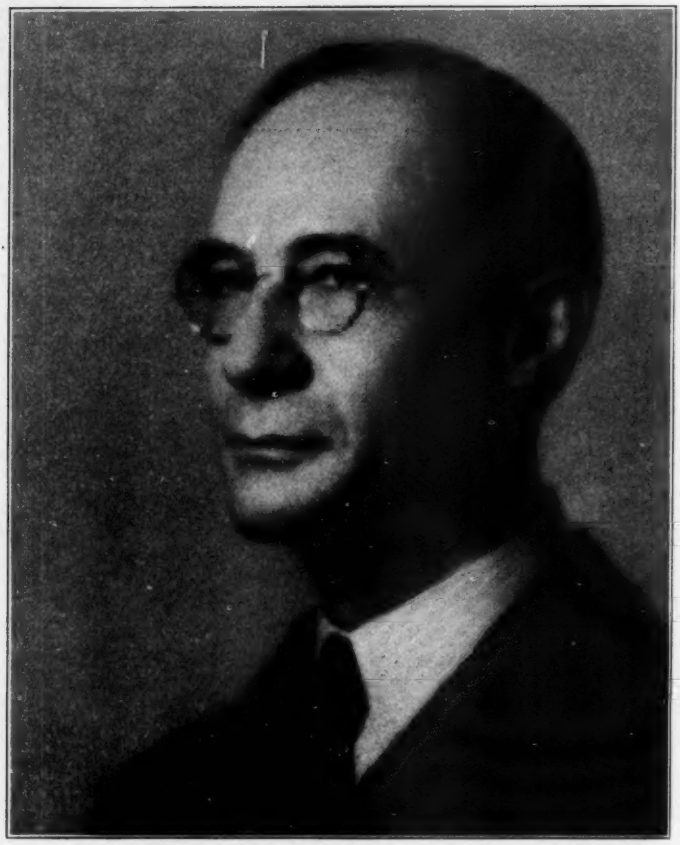

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THE JOURNAL *of the*
AMERICAN DENTAL ASSOCIATION*
and THE DENTAL COSMOS**

*Vol. 25, No. 7 JULY 1938 **Vol. 80, No. 7

PRACTICAL PREVENTION IN PEDODONTIA

By WALTER T. MCFALL, D.D.S., Nashville, Tenn.

IF the dental profession merits and maintains its position as a useful and necessary branch of the healing arts, it must give more consideration, information, instruction and attention to the child patient. Every honest, loyal, well-informed member of our calling is obligated, by the laws of Nature and of man, to work unceasingly to eliminate the conditions making our profession necessary, and to help prevent and relieve our children of the pain, ill-health and morbid sequelae of the most prevalent disease of the human race—decay and infection of the teeth.

It is an inspiring occasion in the life of dentistry when we adopt as the central theme of this meeting, "Preventive Dentistry in the Interest of Health." I appreciate the privilege of appearing before this Section, which carries such a tremendous responsibility for the successful progress, great service and comprehensive practical benefit of general dentistry. On the work of the general practitioner must our profession go forward or fail. Operative dentistry has been defined as, "that branch of oral health service which deals with operations on the hard tissues of the teeth called for by caries, abrasion, erosion, hypoplasia, minor fractures or impaired function." The operations you perform have for their object the inhibition of pathologic processes, the restoration of normal anatomic form and function and the improvement of appearance.

Members of this Section must be sincerely concerned with the clinical, the practical and the workable in their daily practice. Having been in general practice in dentistry, I am thoroughly cognizant of the general all-round versatility and outstanding capability each of you is supposed to possess. You are expected to know all phases of dentistry, to examine, diagnose, treat and correct all degrees of disease, mutilation and unsightly conditions of the mouth and its component parts. It will be my endeavor to present to you the important and essentially necessary service that we must give to children, if preventive dentistry is to make an actual health contribution.

(Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 14, 1937.)

Surely we have no alternative but to give our best to the child patient as we are permitted to help him shape his destiny and obtain and maintain that condition of life which enables a person to live most and to serve best—good health. More than 2,300 years ago, Hippocrates said, "Diseases should be combated in their origin." Goethe has told us, "Little can be accomplished for grown-up people; the intelligent man begins with the child."

People are interested in health and only recently a survey requiring two years and costing more than $25,000 to determine what adults really wanted information on, what they wished to study, brought the interesting answer, "Health is the prime interest of adults." Many of our present-day lawmakers are rediscovering Disraeli's profound thought of other years: "Public Health is the foundation on which reposes the happiness of the people and the power of a country. The care of the public health is the first duty of a statesman." Because the modern educator has learned that "knowledge is the foe of disease," and more, that "knowledge without health cannot profit us," the National Educational Association has gone on record as endorsing the fact that first and foremost among its seven objectives are the teaching and practical inculcation and utilization of health.

Yes, our people are learning that "the mouth is the show window in which the body displays its physical wares." No dentist has any reason for not serving children unless he is temperamentally unsuited to do so. He should then be honest about it and refer children to others who are well qualified and eager to serve them. "Progress is the law of the universe," and any one who will not bend his will to this law not only handicaps himself but also deprives those whom he should serve of their rightful part in all that is highest and best.

The objectives and practice of dentistry have passed through many stages, which have in the last few years resulted in extensive service and ever-enlarging responsibilities. In the beginning, dentistry was chiefly a means for the retention of loose teeth and for the artificial restoration of lost teeth to disguise disfigurement or disability. In dentistry's evolution, dental defects have been repaired and lost teeth replaced with increasing regard for esthetic and functional aspects of dental reconstruction. Many centuries passed before any attention was given to the irregularities in the position of the teeth or means of limiting the extension of decay for the conservation of defective teeth was given consideration. Even then health service was decidedly a subordinate purpose, being achieved mainly by the extraction of diseased teeth.

In recent decades, notable advances have been made in technical repair, remedial treatment and artificial replacement of defective teeth. The advent of roentgenography in dental practice a quarter of a century ago focused attention on dental infection and rendered invaluable aid in the detection and diagnosis of hidden ailments of the teeth and supporting tissues. The general recognition that infectious maladies of the teeth and gums may cause serious disease in other parts of the body definitely placed dentistry in a highly respected position in the healing arts. Oral hygiene, as a prerequisite to the control and prevention of dental disorders, has received increasing attention. Recent findings regarding chemical biology, physiologic diets, nutritional influences, balanced glandular function, etc., have made the development and application of means for the prevention of dental disorders and of their systemic sequelae the paramount duty of each member of the dental profession. Surely we now agree with Dr. C. N. Johnson when he says, "To prevent

disease is more laudable always than to cure disease."

With its achievements and advances, the field of preventive dentistry has not been kept abreast of preventive medicine because the etiology of dental diseases is not fully understood. We do, however, have preventive measures which are fairly effective if intelligently utilized. Defects and irregularity of the teeth and infection of the gums are the leaders in the diseases which afflict human beings. True prevention of dental disease is primarily a matter of education rather than the result of therapeutic or operative procedure. Any procedure employed to prevent or remove the cause rather than the effect of dental disease is preventive dentistry. Most of the disease-producing conditions affecting the dental tissues are preventable, if known and if suitable measures are applied before the birth of the child and during infancy and childhood.

One of the fundamental principles of pathology is that disease results from limited adaptability of an organism to its environment, to the point where it is unable to make the necessary adjustment. Thus, the basis of the prevention of disease is suggested. First, the environment of the mouth may be planned and controlled so as to bring it within the range of adaptability of the organism. Second, the range of adaptability of the organism to the environment of the mouth and teeth may be increased. Prevention in dentistry is actually considered in two phases: 1. The prevention of oral diseases and disorders by proper prenatal care, hereditary influences, proper and adequate diet, home care, exercise, etc. 2. The early recognition and elimination of pathologic processes before much damage has been done—sometimes known as the remedial phase of preventive dentistry. Conspicuous among the remedial measures in dentistry are regular and systematic dental prophylactic treatment employing ammoniacal silver nitrate to immunize the more vulnerable and susceptible areas of the teeth, prophylactic odontotomy, muscle training, preventive orthodontics and all other measures which tend to decrease or inhibit oral disease, and to arrest the progress of lesions which have already occurred.

The two chief factors in failure to give more attention and consideration to the problem of prevention are, first, the fact that the profession has lacked definite knowledge concerning the etiology of dental diseases, such as caries, abnormalities and many periodontal conditions; and, second, that, owing to a lack of knowledge as to how to serve the child patient pleasantly and successfully, the compensation and financial reward has not been satisfactory as compared to that from restorative or corrective service. The dental profession has failed to educate and to develop a proper appreciation of and insurance as to what preventive dental service can render.

Prevention in dentistry, as I shall use the term henceforth, is the effort which is made to maintain normal development and physiologic function and to prevent diseases of the mouth and adjacent parts. Let us visualize and strive to maintain the healthy mouth, and correlate by cooperative aim all phases of hygiene and prevention in dentistry. The application of the various principles of preventive dentistry must be varied according to the age of the patient. Specific problems arise and certain hygienic and prophylactic measures must be employed. The inheritance, development, nutrition and functioning of the body, the various services, the advice and the instructions of the dentist, the activities and cooperation of the individual and of the home must all have a place, a part, if the health of the patient is to be conserved.

In the work of preventing disease, we must consider seriously the interdependence of physician and dentist. The sci-

ence of dentistry had its actual beginning in a medical college and the first faculty included many possessing the doctor of medicine degree. One of the founders of the first school of dentistry, Chapin A. Harris, in 1840, enunciated the objectives of the school as, "to give those who receive its instructions a thorough medico-dental education, so that when they enter upon the active duties of the profession they may be enabled to practice it, not alone as a mere mechanical art, but upon sound, scientific principles, as a regular branch of medicine." Even in one of the very first textbooks used, we read, "Prepared with particular reference to the morbid connections certainly existing between the teeth and the rest of the body."

We have learned from our research workers that dental caries, especially in children, is often regarded as an important focus of infection. Since the exciting cause of dental caries is unknown, preventive measures necessarily are somewhat empiric. As tooth development for all the deciduous teeth begins in intrauterine life, and the follicles of both deciduous and permanent teeth are very evident shortly after birth, one may well and fairly conclude that the problem of satisfactory development, and of the prevention of dental caries in part at least, up to the eruption of the first teeth, is one for the physician. Since the dentist has little control over these early factors in dental disease, we must depend on the physician to establish and maintain such measures as we believe to be preventive or therapeutic.

There is entirely too great a difference between preaching and practice in regard to children's dentistry, or pedodontia. The dentist who fails to prepare himself as he should is causing untold suffering, anguish and sickness for the years which lie ahead. We little realize how much damage and doubt are caused by false statements to parents and children who trust the dentist implicitly. The laity is placed in such a quandary that they do not know what or whom to believe, and many times they are forced to doubt the importance of dentistry or its efficacy as a health measure. We cannot advertise, we can only prove by exceptional and outstanding service to our child patient that we are interested in serving the child in dentistry.

When an adult comes into our reception rooms, what is there to show him that we are interested in children? Is there a child's chair, a corner settee with small blackboard and chalk for children to entertain themselves while waiting for their regular appointment? Is there any appeal to children, or to parents of children, in the reception room? Suitable books, magazines, educational booklets will all interest children and parents, helping to make boosters and friends of the finest class of patients, instead of knockers and procrastinators as regards future visits to the dental office.

Is the operating room equipped with either an additional removable small seat for the child patient or a board with padded seat to assure the child patient of being more comfortable and easier to serve while sitting in the dental chair built for adults? An operating stool is of great assistance to the dentist, and helps toward a friendlier eye-to-eye contact with the child in the dental chair. Where it is possible, the necessary instruments should be placed on the bracket table and covered with a clean towel before the child is seated. The thoughtless, clumsy placing of metallic instruments from the dental cabinet on the bracket table in the presence of the child often frightens him or magnifies his prejudices and fears. Often a tongue depressor, a cotton applicator of wood or something in the child's world and previous experience offers a tremendous help to winning the new patient.

Neither the office nor the reception

room should be equipped or decorated as a day nursery, fairyland or the like. It is not necessary or expedient that an expensive, fanciful and impractical display of articles of childish appeal be instituted in your operating room. An elephant cotton container, a sand dial, or a dog débris-receiver elicits favorable notice from the average child. Because psychology plays such a large part in any successful dental practice, warm pleasant-tasting red solutions and flavored dentifrices, and understandable, intelligent explanations to the child patient pay big dividends in loyalty, cooperation and admiration. Other aids—the use of a large hand mirror, the appeal to a child regarding his looks, comfort, ability to play, the opportunity to grow up to be a big man or a beautiful woman—may be employed, and ever the best and positive should be stressed. Children should always be told the truth, for, even in later life, they never forget and seldom forgive deception. The child patient should be treated as we treat our adult patient. The dentist should imaginatively be the age of the child he is serving, but must not make babies of them or talk baby talk to them.

If we are to prevent dental caries and periodontal disease, we must not only visualize the so-called normal healthful mouth, but must also strive eternally to maintain oral health. Ideally, children should come to the dental office with their parents on a visit that is not a professional call. They should be told at home of the helpful, friendly and capable dentist who is interested in boys and girls. If brought in on a visit, before a professional call, the child becomes better acquainted, and is more favorably impressed, and the occasion is one of pleasure and zest. The little child may accompany the mother when she comes in for her periodic oral prophylactic treatment. The child is seated on the foot of the dental chair or in a small chair nearby and not too much time or particular attention is given him. A cotton roll suffices as a doll or as a baseball bat.

The child patient should come to the dental office at 2 years of age and a parent should always be present on the first visit. What should be done? Bearing in mind the psychologic and educational approach, we should show the child and parent the correct type of toothbrushes and give a sand dial and a directional and informational dental health booklet. On this first visit, we should take the family and patient history, and finally we should give a short, illustrated health talk to both parent and child. The dental hygienist or assistant can very materially help with this eventful visit.

On another short visit, the child should be urged to inspect the teeth in a large hand mirror or an adjustable wall mirror of suitable height. A cursory inspection of teeth, gums and arches as to alinement and abnormalities is made with a tongue depressor, silver spoon or mouth mirror. Any necessary and simple anodyne treatment and home care may also be given on this visit. On these visits, the time is short and the routine handling of parent and child is enjoyable and productive of many dividends for the future.

When the little patient comes for the first dental engagement, the home care and preparation will have been properly supervised and is conducive to cooperation and a good time in the dental office. It is well to explain to the child what we are going to do; to demonstrate the polishing of the teeth by lightly running the rubber cup over the knuckle or finger nail. The teeth are cleaned, the child rinsing the mouth often with hydrogen peroxide colored red and pleasantly flavored with cinnamon water to remove stains from the teeth. If it is a case of the first toothache, it is treated painlessly by having the child rinse the mouth with a warm pleasant-tasting red mouthwash, then drying the cavity and inserting a

dressing and treatment of one of the several anodynes.

Dental engagements for little children should be arranged for early in the morning or afternoon when they are rested. In order to know the true condition of a child's mouth, we must give a thorough oral prophylactic treatment, followed by clinical examination with sharp explorers, mouth mirrors, transillumination, bitewing and intra-oral roentgenograms, photographs, impressions and study models. The binocular loupe and the stomatoscope afford one a third eye in mouth examinations.

The operator should always be patient, encouraging, kind and firm. He should bear in mind a child's thoughts, fears and prejudices, and, remembering what busy, impatient little fellows they are, work thoroughly and effectively and for a short time only. The child should be encouraged to ask questions, to assist the dentist where possible by simple little endeavors, and to actually have as much accomplished at each appointment as possible. We must insist on home care and parent and patient responsibility and urge the child to bring his toothbrush to the office at each appointment.

Although by seeing children early, regularly and often, we may not be able to prevent dental caries, surely we should be able to carry the majority of our patients through to the adult period of life with a full complement of useful, strong, beautiful teeth, healthy gums and well-formed arches. These more effective methods of preventive dentistry mean for the patient less painful dental service with minimum danger from focal infection and at far less expense; and for those of us endeavoring to more nearly be the men our patients expect and believe us to be, less arduous service, with far greater satisfaction in its accomplishment and, yes, increased patient appreciation and compensation.

There are many schools of thought and a great diversity of theories in the dietary and nutritional field. We all agree that diet is most important and that it should be supervised from the prenatal stage through adolescence. Specific problems require specific handling. Common-sense diet lists of appealing proportion obtainable by the average family seem most reasonable. Children should be given what they ought to have at regular meal times, rather than what they think they want. In-between eating and the too large consumption of trashy knick-knacks curtail seriously any attempts at a balanced, adequate diet. Parents unconsciously influence their children in the selection of food. Cod liver oil and calcium products, should, just as well as milk and vegetables, be considered foods and not medicines. Good teeth are born, but diet greatly influences the development of the teeth and their supporting structures.

The unusual work of immunization of tooth surfaces with ammoniacal silver nitrate has been well presented by James Mark Prime. This recognized blessing should be employed more and more. For years, we have proved the sterilizing and otherwise beneficial qualities of ammoniacal silver nitrate in many dental uses, and I sincerely hope it may be used more and more in incipient caries in the mouths of children.

Scientific and tested statistical data indicate those surfaces of the teeth most susceptible to dental caries. Why, then, do we refuse to classify and diagnose these cases and employ prophylactic odontotomy? It is an incontrovertible axiom that "the enamel defect of today is the carious cavity of tomorrow." Any practical, reasonable and inexpensive measure which is simple in its application and scientific in principle, because it is based on facts, is certainly worthy of consideration by those who are desirous of making progress toward the betterment of health and the increased happiness of their fellowmen.

Time does not permit consideration of those all important details concerned with the remedial phases of preventive dentistry: deciduous cavity preparation; the sterilization of deciduous cavities; the use of anatomic forms differing from permanent teeth; the employment of anodyne bases instead of cements; the utilization of matrix bands that do not have the disadvantages of present-day matrix retainers; the use of filling materials versus temporary treatments; wellnigh painless extraction of deciduous teeth under procaine without epinephrine; the joy of using ethyl chloride as an analgesic, not a refrigerant; the possibilities of preventive orthodontics and space retention and the treatment of stomatitis, Vincent's infection, abnormalities and fractured incisors.

The dentist who believes that "Human progress marches only when children excel their parents," and that it is more desirable to build strong boys and girls than to repair grown men and women, will do his best to prevent these diseases which keep children from being healthy, happy and useful.

If the atomic theory proves sound, we have unearthed a vast reservoir of power, but it is physical power. All the world does not equal in power the quiet strength of one unselfish love. We speak not now of the love of man for woman; nor of the love of parent for child. The greatest motive power in all the world is the love of a real man for his brothers, that tender, unselfish regard through which his soul is connected to humanity. Such a love is reciprocal; it cannot, by reason of its generation, be aught but an alternating current of good feeling.

Medical Arts Building.

DISCUSSION

John C. Brauer, Atlanta, Ga.: Dr. McFall has taken into consideration the mechanical as well as the biologic phases of prevention. There has been no time in the history of dentistry wherein so much effort and thought has been directed toward preventive principles. There are approximately 45,000,000 children in the United States, and between 2,000,000 and 3,000,000 are born each year.

The questions may be asked, first, What plans has the profession made to reduce the incidence of dental disease, in this and the coming generations? and, secondly, What plans have the dental educators made to prepare their students to meet these problems? Question one may be answered by stating that lay educational programs have been introduced by the profession at large within the civic organizations, as well as in the public schools. The ideal time for the presentation of preventive principles is in the early grades of the school. It is here that the child is easily impressed, and the habits attained in early life are those that will remain throughout the years. It is too late to start a new series of habits in the middle-aged or older person. Dental disease, including decay, periodontoclasia, malocclusion and the many infections, are well on their way of destruction in the late teens and upward.

The answer to question two, regarding the teaching of students in the field of prevention in the dental schools, is somewhat more hopeful than it was a few years ago. The subjects under children's dentistry, including preventive orthodontics, oral hygiene, endocrinology and nutrition, are all in the realm of prevention.

How may the profession then approach the question of prevention in a practical way?

1. The expectant mother must supply the fetus, as well as her own body, with the essentials. A house that calls for 100,000 bricks cannot be built with 50,000 bricks, and neither can teeth be developed by the fetus, or maintained by the expectant mother, without at least 1 gm. of calcium a day. The beginning calcification of teeth is noted approxi-

mately in the fifth month of fetal life. A minimum of 1 quart of milk is necessary and, with it, a minimum of 3 teaspoonsful of cod liver oil or its equivalent. The cod liver oil furnishes vitamin D, which is absolutely necessary to the calcification of the bones and the teeth. A minimum of 8 ounces of orange juice or tomato juice is essential for supplying vitamin C. Vitamin C is necessary for the protection of the mother's gums, and, too, aids in the calcification of the teeth of the unborn child.

Every expectant mother should be under the observation of a competent physician or obstetrician.

2. The immediate postnatal diet is most important in that the permanent teeth start to calcify soon after birth. The first permanent molars, the cuspids, the lower lateral incisors and all the central incisors start to calcify between birth and the first year of life. The first permanent molars, as well as the other teeth, are much more susceptible to pits and fissures if there is a deficiency of any of the essential elements.

A growing child should have not less than 1 quart of milk, and not less than 1 teaspoonful of cod liver oil per day, or its equivalent, until 14 years of age. It is true that two children of approximately the same age may sit at the same table and eat the same foods, and the one child will develop caries, and the other will not. This does not prove that nutrition is unimportant, but that there are other factors in prevention. The basal metabolism is governed by the thyroid, the pituitary, the parathyroid and other endocrine glands, which may be in a state of malfunction in the one child, and normal in another.

The work of Bunting and his collaborators show that one person may harbor *B. acidophilus,* and another may be free from this organism. They state that *B. acidophilus,* in the presence of a carbohydrate, will produce lactic acid, the active principle in decay.

A number of investigators have advised a low sugar intake as a preventive of dental decay.

3. The mechanical approach to prevention has been championed by Thaddeus P. Hyatt in his teachings on prophylactic odontotomy. His statistics show that the chances are over 2,500:1 that decay will occur in a pit or fissure. Hyatt, in discussing prophylactic odontotomy, says, "It is intended to prevent the inception of decay in pre-carious pits and fissures." I do not believe that silver nitrate should be used in treatment of pits and fissures. I do favor the use of silver nitrate on smooth surface etchings as suggested by Dr. McFall. One has only to section a few teeth showing pits and fissures to note that a large percentage are decayed far into the dentin. As it is almost impossible to tell the depth of an apparently harmless pit or fissure, it is advisable that all pits and fissures be filled that the cavity may be kept to a minimum.

The practitioner who tells his patients that, "this cavity is not ready to be filled," and that he will "watch it for six months," is certainly not applying preventive principles. Patients vary as to susceptibility to dental decay, and it is impractical and impossible to determine how long a pit and fissure will remain immune. The only safe and logical procedure is to eliminate these potentially carious areas with a filling. The advantages in the practice of prophylactic odontotomy are: (1) the elimination of the deep painful cavities; (2) the preservation of millions of teeth; (3) the reduction in number of infections; (4) the prevention of a large number of cases of malocclusion due to early extraction, and (5) the reduction of time and cost to patient and dentist.

CAVITY PREPARATION FOR DECIDUOUS TEETH

By RALPH O. WAGNER, D.D.S., Oakland, Calif.

CAVITY preparation in deciduous teeth constitutes the groundwork on which the success of a children's practice depends. This all-important phase of dental practice has received too little consideration by the general practitioner, as evidenced by that time-worn comment parents still make: "Why should I take my child to the dentist? The fillings will only fall out."

G. V. Black states[1]:

> This is one of the most difficult subjects in dentistry. Not that caries in these teeth is in any wise different from caries of the permanent teeth, but the conditions under which we must treat caries of the deciduous teeth are very different from the conditions under which we treat caries of the teeth of adults. . . . The technical procedures in making fillings in these teeth would be the same as in making like fillings in the teeth of adults and will not be discussed here. . . . The general rule is that we cannot make metal fillings in these little folk; we will have to resort to other methods. In many cases we cannot reasonably make the proper excavation.

I find most pedodontists taking exception to Black's statement that metal fillings cannot be used in deciduous teeth, but few have taken exception to his statements that the technical procedures of making fillings in deciduous teeth are the same as in the adult.

Those of us who are specializing or are particularly interested in children's dentistry could gain much by patterning our activities after that older branch of operative dentistry, gold foil. Although the placing of a malleted gold filling is one of the oldest procedures of operative dentistry, and although it holds first place in the requirements for operative dentistry in dental colleges, men interested in this operation have found it necessary to form clubs in order to further study the technic of cavity preparation and the manipulation of gold. If it is necessary to do club work and further study the operation in which we are best grounded in our college work, it would seem that that phase of dentistry which receives much less attention in our college curriculum should certainly call for far more intensive work by clubs. On the Pacific coast, as in other sections of the country, we have numerous gold foil clubs. In Southern California, G. H. Baird has over a dozen clubs meeting monthly to discuss cavity preparation, and he himself has devised the invisible Class III cavity preparation in order that foil restorations may be made in the mouths of those persons who prefer not to have gold showing in the anterior teeth.

In Seattle, W. I. Ferrier has several clubs, and he has developed a cavity preparation for the treatment of gingival cavities in which noncohesive gold foil is used, thereby reducing the time and strain of this painful operation for both operator and patient. In San Francisco, Robert W. Rule and Harry A. True each direct a foil club, both men giving special attention to minimizing the number of instruments and the number of changes necessary, and thereby reducing the strain of the foil operation on both operator and patient. We find these foil clubs endeavoring in every way possible to reduce the

(Read before the Section on Children's Dentistry and Oral Hygiene at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 14, 1937.)

operative time, thereby making good dental service available for a lower fee in this day of a bargain-minded public.

In reviewing the dental literature of the past five years, I find much space given to the percentage of decay in deciduous teeth, and the discussion of whether a cavity is due to dietary, glandular, hereditary or prophylactic conditions. Many times, a theory of G. V. Black's appears in these articles; namely, that cavity preparation is essentially the same for the deciduous teeth as for the permanent teeth except for the difference in size.

One of the most valuable contributions in the field of children's dentistry in recent years is the work of James Nuckolls of the University of California. He has spent three years studying hundreds of deciduous teeth to establish the minute morphology of the deciduous molars. Also, from castings of the pulps of these teeth, he has established the relationship of the pulp to the gross structure of the deciduous molars. His work was shown at the American Dental Association meeting in San Francisco, the Midwinter Meeting of the Chicago Dental Society and the California and the Southern California

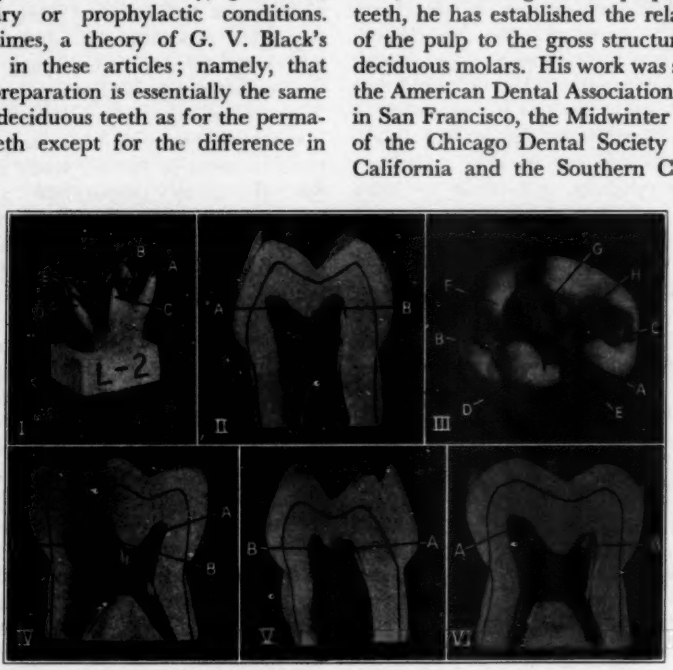

Fig. 1.—I, lower right second molar pulp. II, cross-section of second deciduous molar showing relationship of pulp to enamel (mesial section). III, lower right second molar (occlusal view). IV, mesiodistal section of lower right second molar (buccal view). V, buccolingual cross-section (distal view). VI, mesiodistal section (lingual view). (Courtesy of James Nucholls.)

If this is true, why is it that so many deciduous fillings are lost? We have had in our offices patients of college instructors in dentistry, men who do excellent dental work for adults, yet the fillings which they place in deciduous teeth do not remain for any length of time. It is little wonder that parents consider dental care for children a waste of time and money.

State Dental Association meetings. Through the courtesy of Dr. Nuckolls and the University of California, I wish to present a few illustrations of his methods of preparation of cavities in deciduous teeth. (Fig. 1.)

Returning now to the consideration of cavity preparation and keeping in mind the tooth and pulp morphology which we have just reviewed in the illustrations, let

us seek a cavity preparation which will conform to the limitations of the deciduous tooth, and yet give us sufficient retention to insure the placing of a filling which will give service for the life of the tooth. Also let us keep in mind the speed of operation in order that fillings may be placed with a minimum strain on the operator and patient, and make possible a low fee. In the technic which follows, it will be noted that a more extensive use of burs is recommended than by many other writers who emphasize the use of hand instruments in children. Charles A. Sweet has followed this technic for fifteen years and can testify to the longevity of the filling.

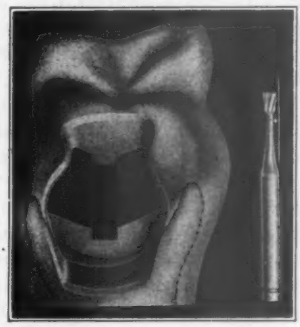

Fig. 2.—Class II cavity preparation, proximoclusal view. (Figures 2-4 are presented through the courtesy of Charles A. Sweet.)

We have found that apparently burs do not cause as much pain in a child as in an adult patient. John A. Marshall, pathologist of the University of California, explains this from the fact that the apical orifice of the deciduous root is only completely formed for a very limited period. During the rest of the life of the tooth, the orifice is large owing to the action of the odontoblasts and osteoclasts, and this allows free passage of blood to and from the pulp chamber, so that when a tooth becomes slightly heated by the bur, the excess blood may rush through the apex more rapidly than in the case of a permanent tooth with a completely formed root.

I shall now review the cavity preparation as developed and recommended by Charles A. Sweet, calling attention to the use of burs in establishing the safe depth of the cavity and obtaining undercuts for the maximum retention of the silver amalgam filling.[2]

CLASS I CAVITY PREPARATION

Type A: Beginning Caries.—1. With a number 33½ inverted cone bur in the contra-angle handpiece, the carious pit is entered and all faulty or precipitous

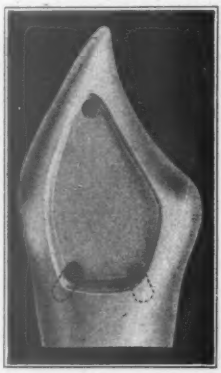

Fig. 3.—Class III cavity preparation.

grooves are cut out to smooth enamel areas.

2. With a number 35 inverted cone bur in the contra-angle handpiece, the grooves are enlarged.

3. This is followed by a number 700 tapered fissure bur, to further widen the grooves.

4. The smoothness of enamel is obtained by tilting the handpiece buccally and lingually around the periphery of the cavity.

5. Any remaining caries is removed with a number 5 round bur or with the 10-6-12 spoon excavators.

Type B: Deep-Seated Caries.—1. The number 33½ inverted cone bur in the contra-angle handpiece is used for all faulty or precipitous grooves, beginning just below the dentino-enamel junction in the carious area.

2. This is followed by a number 35 inverted cone bur, to enlarge the grooves.

3. Further enlargement, if considered advisable, is accomplished with a number 37 inverted cone bur.

4. The outline form of the carious area is best extended with a number 43 mounted stone or a number 702 tapered fissure bur in the contra-angle handpiece.

5. By tilting the handpiece buccally and lingually, the smoothness of enamel is given to the periphery of the cavity.

Fig. 4.—Class IV cavity preparation with lingual dovetail.

6. All remaining caries is then removed with a number 5 or 7 round bur and sharp 15-8-12 excavators, even though the pulp may be exposed.

CLASS II CAVITY PREPARATION

1. An opening is made in sound tooth structure in one of the pits with a number 1 round bur in the contra-angle handpiece to a depth slightly below the dentino-enamel junction.

2. A straight cut is next made from this pit into the proximal carious area with a number 33½ inverted cone bur.

3. This cut is then widened with a number 35 inverted cone bur. If the proximal wall is not broken down, the 35 bur is dropped into the carious area and the proximal portion is opened by drawing the bur up through the marginal ridge. Then, with the same bur, the gingival floor is extended buccally and lingually.

4. With a number 37 inverted cone bur, the occlusal step is fully prepared. The operator should cut no deeper than just below the dentino-enamel junction, so that the finished preparation of the occlusal step will follow the inclined planes of the cusps. In this way, the horns of the pulp under the buccal and lingual cusps will not be endangered.

It may be emphasized that the greatest width of the occlusal step must be at the junction of the occlusal with the proximal wall.

5. This occlusal step should be undercut to the depth of the cutting blades of the number 37 inverted cone bur, or 0.5 mm.

6. If additional bulk of filling material is desired, a deeper cut is made with the number 37 inverted cone bur in the central portion of the step, the exact width, and a depth of about one-half the cutting blades of the number 37 bur. This will not endanger the pulp of the tooth.

7. With the occlusal portion complete, the 37 bur is dropped to the gingival floor and extension for prevention completed. Overhanging enamel on the buccal and lingual margins is chipped off with a 15-8-6 bin-angle chisel. The operator should not attempt to square up the buccogingival and linguogingival angles to a level with the center of the gingival floor, for the caries always penetrates deepest in the central portion of the proximal surface, unless it is a very shallow cavity. The gingival floor should be no deeper pulpally than the width of the cutting blades of the number 37 inverted cone bur. The bur is drawn up the buccal and lingual margins from the

gingival, the interproximal embrasures being enlarged.

8. All carious dentin is removed, even if the pulp is exposed, with 15-8-12 right and left spoon excavators or a number 5 or 7 round bur.

9. With the number 702 tapered fissure bur in the contra-angle handpiece, the buccal and lingual embrasures are evened, and the smoothness of enamel is produced by tilting the handpiece and running the number 702 fissure bur around the periphery of the cavity.

CLASS III CAVITY PREPARATION

The Class III cavity is handled by several different methods. Some operators sterilize the carious area with silver nitrate; others disk the area and do or do not precipitate the nitrate. Unless the time for exfoliation is practically at hand, the caries should be removed and a cavity prepared for a restoration.

1. The carious area is opened by the 33½ or 35 inverted cone bur, the choice depending on accessibility and the extent of the caries. With the 35 inverted cone bur, all caries is removed and the outline established, but the bur should not extend pulpally any deeper than the cutting blades of the instrument.

2. With the 33½ bur, retention points are placed at the linguo-axiogingival and labio-axiogingival areas parallel with the pulpal wall.

3. Remaining decay is removed with the 10-6-12 spoons and the enamel planed with the 15-8-6 bin-angle chisel.

CLASS IV CAVITY PREPARATION

1. With a number 33½ inverted cone bur in the contra-angle handpiece, a cut is made in the central portion of the labial or lingual surface, from the proximal cavity to the median line of the tooth, only as deep as the cutting blades of the bur.

2. This original cut is extended entirely gingivally with a number 35 inverted cone bur in the contra-angle handpiece. In order to obtain width for the labial or lingual dovetail, the cut should always be carried to or below the gingival margin of the gum tissue. The greatest width of the dovetail should be at its junction with the proximal cavity. This dovetail should not be cut deeper than the cutting blades of a number 35 inverted cone bur.

Fig. 5.—Left: Lower right second deciduous molar, mesial section. Right: Tooth shown at left with bur in place. The safe depth for use of a No. 37 inverted cone bur is shown.

3. The proximal portion of the cavity is now prepared as the Class III cavity with the number 33½ and 35 inverted cone burs in the contra-angle handpiece, but the incisal retention point is omitted, as it would perhaps dangerously undermine the incisal edge.

CLASS V CAVITY PREPARATION

Class V cavities are entered with a small inverted cone bur and are gradually enlarged to a reasonable size. The operator should take advantage of the slight undercuts caused by the cutting blades of the inverted cone burs in order to secure sufficient retention. All remaining caries is removed with the 10-6-12 right and left spoon excavators. The smoothness of enamel is obtained by using the 15-8-6 bin-angle chisel.

Illustrations of these cavity preparations are presented by courtesy of Charles A. Sweet. Also, a few sections show the relationship of the cavity preparation to the pulp. (Figs. 2-8.)

SUMMARY

The work of James Nuckolls on deciduous tooth morphology gives a detailed description of the tooth and the relationship of the pulp to the enamel.

2. The writings of Black and others in the past, although they have withstood the test of time as far as permanent teeth are concerned, have not given us information relative to deciduous cavity preparation, and should be disregarded.

3. Through the trial and error method, the cavity preparation of Dr. Sweet has been developed, and does conform to the morphology of the deciduous tooth. I recommend its universal acceptance until a better system of cavity preparation is presented.

Fig. 6.—Lower right first deciduous molar (buccolingual section).

Fig. 7.—Upper right second deciduous molar (buccolingual section).

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2940 Summit Street.

DISCUSSION

Nathan B. Scherr, Baltimore, Md.: Dr. Wagner's paper not only revives interest in children's dentistry from the standpoint of a more scientific technic but also reminds us of the persistent indifference of the profession toward this important phase of dental practice. Some of us look on any agitation for increased general interest in pedodontia as strictly modern. This is not true. Dental history reveals the fact that great interest in this subject has marked all ages. But, in all cases, it has been significant that only a few in each age were interested and that all efforts to enlist general support of a better service to children have been futile. In my opinion, the most important problem before us is to encourage the profession to apply the advances which a few have made in this field.

There is reason to believe that an improved interest in children's dentistry can

be achieved if all factors involved in its promotion are made to cooperate. There is a growing effort on the part of local, state and national dental societies to extend the sphere of usefulness of the new knowledge on this subject. These societies have invited the more interested members of the profession to appear on various programs, thus promoting interest in the subject. However, indifference will continue until such time as the scheme of dental education places proper emphasis on pedodontia as a necessary part of teaching, in theory and technic and clinically. The efforts of educators can be strengthened by state boards in fixing requirements as a test of fitness to practice. These arbitrary requirements will establish a different attitude in future generations, just as the teaching of the use of foil gold and its acceptance as a test of fitness to practice has made proficiency in gold restorations universal.

If it is assumed that there is a demand for better service for children, the fact remains that a practicable, workable and effective technic and a sound theory of approach to its many problems are wanting. It is true that often the general practitioner, in his humble way, makes an honest effort to meet this problem, but it is also true that many neglect their duty to their patients when they are confronted with the need for careful treatment of deciduous teeth. Although neglect of the latter is not to be condoned, it is true that both groups suffer for want of a more scientific mode of approach to the subject. In fact, it is true that many who fail to treat deciduous teeth do so more from inability than in wilful neglect. Because of this failure, there is a general impression among the public that it is unnecessary to fill deciduous teeth. This attitude has been fostered by the many dentists who discourage any who may show an interest in the treatment and preservation of deciduous teeth. Organized dentistry should zealously endeavor to break down this myth regarding care of deciduous teeth, through a system of lay education, and dental education should supplement this effort by making available to the dentist a well-defined course of instruction that would equip the general practitioner to meet this responsibility.

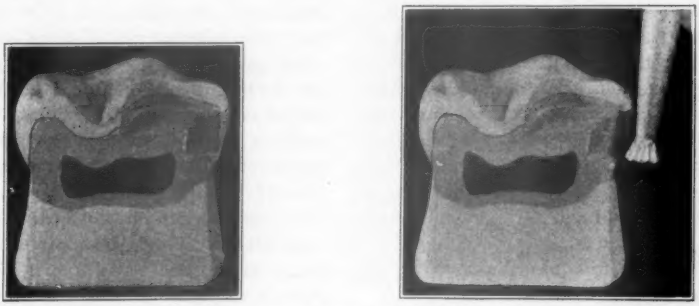

Fig. 8.—Left: Lower left first deciduous molar, mesiodistal section through central pits. Right: Cavity with bur in place.

Dr. Wagner has followed rather closely the principles set forth by Charles A. Sweet in the *Dental Digest* for May 1935, but in his recommendations has wisely left much to the judgment of the operator. Those of us who have been devoting time and study to this problem have approached it from many different angles; consequently, our views on important

points do not coincide. As a consequence, I find myself in disagreement with many points in his technic.

For instance, in my practice, and in teaching the art to students in the Baltimore College, I stress the importance of hand instruments in cavity preparation. While the bur is necessary, its application is minimized in favor of well-chosen, properly selected, carefully conditioned cutting instruments. It is a maxim in good surgery to use perfectly balanced sharp cutting instruments. At no place is this more important than in children's work. This applies also to burs, but, all things being equal, the hand instrument carefully and capably used produces least shock, is just as effective and can be used with greater facility than can the bur. My experience and that of my students indicate that the child shows least resistance to this technic.

Operative dentistry for children, especially for deciduous teeth, follows the same fundamental rules as good dentistry for adults. Aside from a well-chosen technic, there are certain rules that should be rigidly observed. Important among these are:

1. No defect is too slight to receive careful decisive attention.

2. The deciduous teeth should receive the same zealous attention as the permanent teeth in order to maintain function, preserve normal conditions and promote proper development in the jaws of the growing child.

3. Particular attention should be given to developmental defects in the pits and fissures of the teeth of both dentitions. The benefit of doubt should always be given the tooth and not the pit or fissure. Prevention is promoted by observing this rule.

4. In cavity preparation, the essential elements in permanent and deciduous teeth are the same: Retention should be secured, the outline of the cavity be placed in sound tooth structure and all decay removed. Differences are suggested by variations in tooth forms, tooth dimensions, pulp areas, etc. The judgment of the operator will recognize these and provide for them.

Finally may I touch upon the most important factor in successfully carrying out any predetermined technic; namely, child psychology. Those of you who have taught clinical pedodontia and have had to deal with all qualities of personality in a student body have recognized that human understanding is more often the key to success in dealing with children than is skill in operating. The management of children in an office is mainly subjective and not objective. One must study the child and meet him on his own grounds. To do this, we must have complete control of ourselves and be able to adjust our attitude as soon as we sense the proper approach to the particular patient. Many of us (and again I see the variations in the cross-section of any class of dental students), although possessing the technical skill to deal satisfactorily with any case arising in routine dental practice, do not possess the qualifications of wisdom, judgment and self-control to cope successfully with the many difficulties involved in handling children. To use tact, to know the degree of firmness and kindness necessary to cope successfully with the wide range of child personality, which is governed by instinct instead of reason, spells success.

The future is brighter for more effective work in this field. It is through the efforts of such investigators as Dr. Wagner that the boundaries of usefulness in this field are being extended.

NEUROLOGIC ASPECTS OF TEMPOROMANDIBULAR DISORDERS

By HERMAN CHOR,* M.D., Chicago, Ill.

IN 1934, Costen[1] called attention to a group of symptoms which occur commonly in disturbances of the temporomandibular joint. Headache, neuralgia, ear symptoms and burning tongue constituted the proposed syndrome. The headache was described as severe and constant, localized to vertex and occiput and behind the ears and occasionally supra-orbital, and was likened to that associated with sinus disease. In many cases, the headache increased toward the end of the day, thus resembling eyestrain headache. The ear symptoms included impairment of hearing, stopping or "stuffy" sensation in the ears, tinnitus and dizziness. Burning sensation in the throat, tongue and side of the nose was the third feature emphasized. In addition to these major symptoms, there may be speech defects, bite anomalies, snapping of joints, eczema of the ear canals, facial deformity, pyorrhea and malocclusion.

The excellent results reported by Costen through repositioning the jaw, increasing the vertical dimension of the jaw and "opening the bite" have aroused considerable interest, especially among dentists. Inasmuch as patients seek treatment for headache or pains in the face, deafness or dizziness rather than for the unsuspected mandibular joint disease, it is essential that the medical profession be aware of such a syndrome and of the indications for dental consultation and cooperation. It is extremely important, therefore, that the symptoms of Costen's alleged syndrome be considered carefully in the light of well-established syndromes, or symptom complexes, which they may resemble. The latter conditions are related primarily to the cranial nerves and the central nervous system and hence are of special interest for the neurologist.

Read before the Section on Medical Relations at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 16, 1938.

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NEURALGIAS OF THE HEAD AND FACE

Under Costen's heading of "neuralgias"[2] were included headache about the vertex and occiput and behind the ears and pain in the region of the ear, mouth and tongue. The explanation given by Costen for these so-called neuralgias is as follows: (1) erosion of the bone of the glenoid or mandibular fossa and impaction of the condyles against the thin bone separating them from the dura; (2) irritation of the auriculotemporal nerve, and (3) the production of reflex pain and sensory disturbance in the various connections of the chorda tympani nerve, the condyle irritating it where it emerges from the tympanic plate.

The subject of pain syndromes of the head and face is one that has been of major interest to neurologists for many years. And certainly we recognize that dental conditions are far-and-away the commonest source of face pain. Acute pulpitis may cause tenderness and pain

localized in the region of the involved tooth. Here, the explanation of the pain is a simple one, namely, a neuritis of the nerve filament of that tooth. Later, however, the pain may radiate beyond the affected tooth along the upper or lower jaw, as the case may be, and, indeed, may occasionally spread over the whole area of the fifth nerve distribution. In persons who are particularly sensitive and of a so-called nervous temperament, the pain may be described as extending even into the neck and arm. To be sure, every case of facial pain demands a careful examination of the teeth. On the other hand, there are many syndromes of face and head pain in which the condition of the teeth and the jaws plays no causal rôle. Pain may arise from skin or surface membranes, from fascia, muscles, tendons and joints, from the vascular tree and other sources. We must remember that pain and its characteristics are purely subjective phenomena and hence the personal factor must always be taken into consideration. The recognition of this psychologic factor has led to an appreciation of psychalgia or "mental pain." Another source of pain is lesions within the central nervous system; in the spinal cord, brain stem and brain. The so-called thalamic syndrome is perhaps the best known of such "central pains."

The terminology used to designate pain is responsible for a great deal of confusion and controversy. Thus, the term "neuralgia" is used indiscriminately, not only by the layman, but unfortunately also by the physician and the dentist in referring to pain regardless of its characteristics or location. The word "neuritis" has experienced a similar fate. Neurologists have been trying to establish a more definite classification of pain syndromes based on well established clinical and physiologic data. I should like to offer the following classification: (1) neuralgia; (2) neuritis; (3) referred pain; (4) central pain, and (5) psychalgia or "mental pain."

Neuralgia is a definite and characteristic type of pain and is rather rare as compared with other pain syndromes. To justify such a diagnosis, certain criteria should be present. True neuralgia is characterized by its paroxysmal nature, whereby "explosions" or "bursts" of severe, sharp, lancinating pain strike the patient. Such attacks of pain last only a few seconds, rarely longer than half a minute. This short duration is a cardinal feature of true neuralgia. If the pain lasts longer, that is, for several minutes or a half-hour or more, it cannot be diagnosed as neuralgia. It should be noted, however, that the paroxysms of pain may occur frequently and in quick sequence so that the patient may state that the pain lasts several minutes or even longer; whereas the individual "explosions" of pain are only seconds in duration with short intervals of relief between succeeding paroxysms.

In intensity of pain, neuralgia challenges any other type of human suffering. The excruciating agony which the patient must endure when a paroxysm occurs is a pitiful sight. It has been noted that the sufferer from true neuralgia is not hypochondriacal because when he is not having attacks of pain, he is so grateful and happy that he rarely utters a complaint about any other sensations which may exist within his body.

Another important feature of neuralgia is the distribution of the pain. Neuralgic pains follow definitely the course of the nerve, being clearly localized along one or more of its branches. Other pain syndromes are rarely so strictly localized or so intense and may be distributed over an area beyond that innervated by a particular nerve.

The one essential feature that must be present in order to diagnose neuralgia is the presence of a "trigger zone." There is an area on the skin or mucous membrane surface from which, if touched even lightly, may be elicited an attack

of pain similar to the spontaneous paroxysms. The patient usually is aware of the location of such a spot and carefully avoids contact. This is in sharp contrast to the behavior of patients suffering from other types of pain, who may press deeply to indicate the site of their discomfort. This is particularly true of deep-seated sinus pain.

The neurologic examination of the patient with neuralgia is objectively negative. There is no evidence of disturbed sensation, motion or reflexes, which readily differentiates it from neuritis. Spontaneous remissions are characteristic of neuralgia, which explains many alleged cures following attempts at treatment.

There are few true neuralgias encountered clinically. In the head, neuralgias of the trigeminal and glossopharyngeal nerves are the two that are generally accepted.

TRIGEMINAL NEURALGIA

The most common example of a true neuralgia is trigeminal neuralgia or tic douloureux. This syndrome first mentioned in 1756 by Andre[3] was described classically (1773) by John Fothergill,[4] in his monograph on "Painful Affections of the Face." Since then, a huge literature has been built up covering many thousands of cases. It is a syndrome observed frequently enough in private and clinical practice. The patient complains of attacks of excruciating pain—"like a million red-hot needles"—which shoots through the face in a constant pattern, sometimes confined to the lower jaw, in other instances to the upper jaw, and more rarely radiating up over the temple and eye. In some cases, the pain is distributed along all three branches of the trigeminal nerve. The pain is usually unilateral, but bilateral trigeminal neuralgia does occur. In such cases, however, the disease usually began on one side and continued on that side for some time, perhaps many years, before it made its appearance on the contralateral side (Frazier).[5] Adson,[6] however, has reported several cases in which the neuralgia appeared simultaneously on the two sides. The attack of pain lasts only a few seconds. It ceases as suddenly as it began. It may be brought on by touching a particular spot on the face, as in wiping the face, shaving or eating. The cause of trigeminal neuralgia is unknown. There is good evidence that it is not due to a lesion of the nerve itself nor of its cell bodies of origin in the gasserian ganglion.

The occurrence of the pain in the jaws has naturally brought attention to the possibility of local disease in the structures of the jaw, the teeth and the gums. Almost every patient with trigeminal neuralgia has received dental attention, with removal of one or more teeth in a hope of alleviation of pain. It should be emphasized at this time that no dental condition, infected or traumatized or impacted teeth, however severe, can cause tic douloureux. The pain of dental origin is totally different from true neuralgia. The many reports in the dental and medical literature of the relief of trigeminal or glossopharyngeal neuralgia by the removal of impacted or carious or pulpless teeth are misleading. I have reviewed many case histories of this sort and, in most instances, what has been diagnosed as trigeminal or glossopharyngeal neuralgia is not true neuralgia, but local and referred pain. In some instances, the descriptions warranted a diagnosis of neuralgia. The occurrence of spontaneous remissions in true neuralgia has been mentioned. A coincidental cessation of pain soon after the removal of impaired teeth may be falsely interpreted as a cure due to the treatment. The dental profession should recognize this and be more critical of such reports.

Fay,[7] of Philadelphia, has offered an explanation for trigeminal neuralgia based on the avulsion of the peripheral

dental fibers of the fifth nerve during removal of the deciduous teeth, with a wild redistribution of pain terminals which, if stimulated, register pain in the teeth to be discarded. The harmless permanent teeth which are suspected would be extracted. This hypothesis, however, has received little support. Another more recent explanation of trigeminal neuralgia is that of Frazier.[8] He has suggested that the syndrome is due to peripheral stimulation of the fifth nerve in the presence of a thalamic lesion. The thalamus is a large mass of gray matter located deep within each cerebral hemisphere. It is the chief subcortical sensory center, in which most of the afferent sensory pathways have their destination. From the thalamus, sensations are relayed to the sensory cortex, where they are appreciated as perceptions. It is well established that lesions of the thalamus give rise to spontaneous pain and dysesthesia. The patient experiences outbursts of hot or cold or burning pain of a disagreeable nature referred to the contralateral side of the body. There is also an over-response to peripheral stimuli, so that stimuli which under normal conditions produce mild sensations of touch, pain, hot or cold, or indeed may even be subliminal, now evoke supraliminal and even extremely painful sensations. Such hyperpathic responses are characteristic of central lesions and their location has been verified by surgical experiments on human beings. Further investigation, however, is needed to substantiate or disprove Frazier's hypothesis that trigeminal neuralgia may be of this nature.

GLOSSOPHARYNGEAL NEURALGIA

Paroxysms of pain exactly like those of trifacial neuralgia occur in the area of distribution subserved by the glossopharyngeal nerve. This syndrome was not recognized until 1920, when Sicard and Robineau[9] described three cases, but they were not certain of its origin solely in the ninth nerve. A year later, Harris[10] presented two cases in which the pain characteristically started in the throat in the region of the tonsil and anterior pillar and radiated to the ear and upper part of the neck. He was convinced of the involvement of the ninth nerve in such cases and hence termed the malady glossopharyngeal neuralgia. In this country, Doyle[11] was the first to write on the subject and he added four cases observed at the Mayo Clinic.

This type of neuralgia is extremely rare as compared with trigeminal neuralgia. To date, there are less than 100 cases reported in the literature in contrast to the many thousands of cases of neuralgia of the fifth nerve. It is likely that many more cases occur but have not been recognized as such.

The symptomatology of glossopharyngeal neuralgia is just as uniform as that of trigeminal neuralgia. The paroxysms of pain occur without prodromal symptoms or warning. While talking or swallowing, the patient suddenly experiences sharp, knifelike pains radiating from the base of the tongue or region of the tonsil back toward the ear. The pain lasts only a second or two and is gone as quickly as it appeared. Although swallowing, especially cold or hot liquids, is the most common exciting factor initiating an attack, talking, laughing, yawning and sneezing also may induce the pain. The presence of a trigger zone can usually be demonstrated. The dolorogenic area is most frequently somewhere in the pharynx, but there have been cases reported in which touching the pinna of the ear or moving the auricle forward and back set off an attack.

The paroxysms are excruciating, and during the brief period of agony, the patient often grasps the angle of the jaw or presses firmly on the ear or throat. Just as in trigeminal neuralgia, the paroxysms of pain may occur in rapid succession, so that although each parox-

ysm lasts only a few seconds, the patient may state that the duration of pain is several minutes.

The attacks of pain occur most frequently during the day, some patients being entirely free during the hours of sleep. In other instances, however, a spontaneous paroxysm may occur during the night and waken the patient. Remissions are common and have been reported to last from several weeks to as long as eight years. Glossopharyngeal neuralgia is usually unilateral, but a case of bilateral involvement has been recorded. The physical examination is negative and there are no objective signs, such as disturbed sensation referable to the ninth nerve.

Peet[12] reported five cases of combined glossopharyngeal and trigeminal neuralgia. Cases have been reported in which the paroxysms of stabbing pain occur in the external auditory meatus with occasional radiation to the face and posterior auricular region. These attacks of pain are not induced by talking, eating or swallowing. Such a syndrome has been designated by some as geniculate ganglion neuralgia, a tic of the sensory filaments of the seventh nerve. Reichert,[13] however, has called attention to the fact that the distribution of the pain corresponds rather to the region of the tympanic branch of the glossopharyngeal nerve, Jacobson's nerve. It is cured by section of the glossopharyngeal nerve. Thus it appears that, as in trigeminal neuralgia, a particular branch of the ninth nerve may be involved instead of the whole nerve.

Occasionally, in cases in the literature designated glossopharyngeal neuralgia, it has been asserted that removal of an impacted third molar has brought about a cure. On close analysis of such cases, some are incorrectly diagnosed. The pain syndrome obviously is one of referred pain. In others, the relief subsequent to extraction is probably coincidental. Certainly there is no direct causal relationship between impacted teeth and true glossopharyngeal neuralgia.

SUPERIOR LARYNGEAL NEURALGIA

Superior laryngeal neuralgia is characterized by paroxysms of unilateral, lancinating pain which radiates from the side of the thyroid cartilage to the angle of the jaw and sometimes to the ear. There is a trigger zone at the plica of the nerve in the pyriform sinus. The pain is ordinarily initiated by swallowing, but a similar attack may be produced by touching the trigger zone with a probe. It closely resembles glossopharyngeal neuralgia. In the latter syndrome, however, the pain radiates to the ear from the tonsillar region which is the trigger zone. Echols and Maxwell[14] reported a case of superior laryngeal neuralgia in which cure was accomplished by sectioning the nerve.

In the literature, reference is occasionally made to other so-called neuralgias. Geniculate neuralgia or neuralgia of the facial nerve was described by Hunt[15] in 1907. This syndrome is characterized by pain in the deep posterior orbital, palatal and nasal regions with painful pressure sensations in the face. Pain localized in the depths of the ear and in certain areas of the external ear may occur as a result of referred pain transmitted along the petrosal nerves to the tympanic plexus. Herpetic eruptions may appear over the external ear and the tympanum. Another neuralgic syndrome, so-called sphenopalatine neuralgia, was first described by Sluder[16] in 1908. According to Sluder, there is localized pain in the root of the nose, in and about the eye and in the upper part of the face and upper teeth and sometimes also in the lower jaw and lower teeth, in the temple and about the zygoma, the ear, the mastoid, the occiput and the neck. In addition to the pain, vasomotor and secretory symptoms are described. Congestion of the nasal mucous membrane, with abundant secretion

in the nasal mucosa and protracted sneezing, commonly occurs. Both Cushing[17] and Frazier,[18] however, showed that excision of the sphenopalatine ganglion (Meckel's) fails to relieve in these cases. Vail[19] states that the symptoms attributed to involvement of the sphenopalatine nerve are caused by involvement of the vidian nerve. What he designates as vidian neuralgia, however, is a syndrome, which, he explains, is due to an inflammatory condition of this nerve secondary to maxillary sinus infection. Such an inflammation of the vidian nerve, therefore, should be considered a neuritis and not a neuralgia.

These syndromes and other painful conditions of the face and head have been designated "atypical neuralgia." This term is entirely unwarranted. A pain syndrome is a neuralgia or it is not a neuralgia. Recent reviews by Glaser[20] (1928) and Frazier[21] (1928) have helped to differentiate this group from true trigeminal neuralgia. The pain is not superficial, and it is not referred to the surface as is that of true trigeminal neuralgia, but is deep seated in the tissues, the bone and the eyeball. The pain does not follow the direction of the special branches of a specific nerve, but jumps across anatomic boundaries, often extending into the neck and arm. The pains are often persistent and continuous, not paroxysmal. Trigger zones are not present.

The fact that the true neuralgias can be cured by surgical procedures, sectioning the specific nerve through which the pain is mediated, makes it necessary to have an accurate definition of each syndrome. The atypical neuralgias still constitute a problem both as to cause and treatment.

The failure of surgical measures directed against the trigeminal nerve to afford relief in cases of so-called atypical neuralgia called attention to the possible rôle of the sympathetic nervous system in the production or transmission of painful sensations in the head. (Peet[22]; Frazier.[21]) It has been suggested that vasomotor spasm may produce pain. In some patients, Frazier[21] showed that electrical stimulation of the superior cervical sympathetic ganglion produces pain in the zone of the trigeminal distribution.

Fay[7] has expressed himself strongly as regarding atypical facial neuralgia as a syndrome of vascular pain. Tenderness over the course of the larger vessels of the face and head is found in many cases of such atypical neuralgia. Deep, pressure pain may be transmitted over the facial nerve, as demonstrated by Ivy and Johnson[24] and by Davis.[25] This possible source of atypical neuralgia also bears consideration.

NEURITIS

The term neuritis means nerve inflammation. Pain is almost always present in neuritis and hence the term has been loosely used to designate many and various pain syndromes. The pain may be sharp and may radiate along the distribution of the nerve to its terminal endings. It may also be a dull ache and a burning sensation, described commonly as a pain resembling a toothache. The nerve involved is often exquisitely tender and may be swollen and indurated. The muscles in the same area may also be tender and movements may be inhibited because of pain.

Frequently associated with pain is paresthesia described as a tingling, prickling or numb sensation, a feeling as if the area were asleep—a pins and needles sensation. Such paresthesia is constantly present and remains localized. It is not fluctuating and intermittent.

Objective signs are characteristic of a true peripheral neuritis. Hypesthesia, or anesthesia to touch, pain or temperature are present. In the case of mixed nerves, motor weakness or paralysis of the muscles subserved by the nerve involved may be demonstrated. Changes in reflexes are nearly always present. Although exaggerated in the early stage,

they eventually are diminished or absent. Trophic, vasomotor and secretory changes may be observed. A neuritis may be caused by bacterial invasion, toxemic circulatory conditions, pressure, trauma, etc. The local pain, which is a symptom of many conditions occurring in the face or head, may justly be considered a neuritis of the peripheral terminals of the sensory nerve supply to this area. The pain from dental infection or the presence of submerged teeth is a familiar example of this type of local neuritis. The local pain and tenderness in temporomandibular disorders also are of this nature.

REFERRED PAIN

Referred pain may be considered next inasmuch as it is observed clinically in so many conditions. Many problems relating to referred pain are still unsolved and, as a consequence, several theories have been proposed by different investigators. By virtue of the complex anastomatic connections of the sensory nerves within the cerebrospinal and the sympathetic nervous system, the transmission of painful stimuli may follow a course far distant from the original source of its production. Lesions of deep structures of the body usually give rise to two types of pain. Local pain results from direct involvement of the sensory nerves in the immediate focus of the disease process. In addition, referred pain is produced as a result of the transmission of impulses through a sensory reflex whereby pain is felt in areas remote from the lesion. According to Pollock and Davis[23]:

> The impulses of referred pain travel from the viscera either along with autonomic or spinal sensory fibers to the spinal cord by way of the posterior roots. After passing over a synapse with cells in the anterolateral column, the impulses travel over preganglionic efferent fibers to the autonomic ganglia. A post-ganglionic fiber then carries the impulses to the skin where the sensory end-organs are stimulated (by physicochemical or hormonal changes). Thus, an ordinary somatic painful impulse is produced which travels over the spinal sensory nerves, enters the spinal cord by way of the posterior roots and ascends in the lateral spinothalamic tract to a cortical level.

A common example of referred pain is that which occurs in heart disease. In addition to tightness and a gripping sensation, felt in the precordium, the patient may also experience sharp pain (angina pectoris) radiating down the left arm to the fingers. It is known that pain is referred from the heart to the upper five segments of the dorsal cord and that its chief conduction paths are by way of the inferior cardiac nerves and the stellate ganglion to the upper thoracic sympathetic chain. From these ganglia, the pain fibers enter the left dorsal nerve roots by the white rami communicantes. Surgical experiments performed on human beings in attempting to relieve angina pectoris have established the pathway for the referred pain. The exact pathways of referred pain from the face and head await further experimental and clinical research. Until more precise knowledge is available, it is well to recognize that many explanations proposed are for the most part theoretical.

CENTRAL PAIN

Another possible source of obscure pain syndromes, particularly in cases where careful investigation reveals no local or general physical cause, is central pain. Lesions of the central ascending sensory pathways within the central nervous system may give rise to a particular type of pain, or hyperpathia. Chronic lesions in the thalamus described originally by Dejerine and Roussy are the best known examples of central pain. The patient complains of spontaneous pains and dysesthesias. Slight stimuli applied to the body surface may cause an over-response of intensely disagreeable sensations. For the explanation of central pain, it is proposed that the cortex normally exerts an inhibitory

control on the subcortical centers concerned in the perception of sensations. As a result of lesions in the thalamus or in the central sensory pathways, this inhibitory control is lost. Peripheral stimuli therefore have an exaggerated and unpleasant response. It has been suggested that one type of so-called atypical neuralgia may be of central origin, the lesion probably being located in the trigeminal tract in the medulla or pons.

PSYCHALGIA

Psychalgia or mental pain undoubtedly is present in many cases of face and head pain. At times, it may occur as a result of local suggestion, as after a slight trauma to the head. Or it may appear in connection with a period of emotional stress or worry without any local injury to account for the local pain. The patient's description of the pain usually establishes it as a psychalgia. It does not follow anatomic boundaries and it varies in intensity and character. In such patients, a nervous background is usually easy to establish.

In many cases, a compensation factor is in the background of the patient's invalid reaction. In others, it is the symbolic expression of difficult life situations with which the person is unable to cope. These patients usually have, in addition to their complaint of pain, numerous other symptoms referable to many parts of the body. Careful examination fails to reveal any physical basis for their complaints. Such patients may respond readily to appropriate psychotherapy. It is in this group that many claims of cure are reported as following therapeutic measures of various sorts. The relief obtained in such cases is either the result of suggestion or in the nature of a spontaneous remission.

EAR SYMPTOMS

Ear symptoms have been listed by Costen[1] as constituting a cardinal feature of temporomandibular disorders. They consist of intermittent or continuously impaired hearing, stopping of, or stuffy sensation in, the ears, tinnitus, usually a low buzz and, less often, a snapping noise while chewing, dull or drawing pain within the ears and dizziness with nystagmus. The explanation given for these alleged symptoms is that there is a compression of the eustachian canal by retrusion of the condyle of the mandible and also trauma to tympanic structures. The fact that small branches are given off from the auriculotemporal nerve to the tympanic membrane, the external auditory canal and the tympanic cavity is considered a contributing factor in these ear symptoms. The reports of Wright,[26] Prentiss,[27] Greene[28] and Goodfriend[29] are cited in support of this explanation.

Fifty-two of 165 patients were reported to have varying grades of deafness designated catarrhal deafness. Inflation of the eustachian tube brought about an immediate improvement in hearing, which was taken as proof of the correctness of the idea of an obstructive deafness. Opening the bite likewise relieved this obstruction.

The neurologic aspect of deafness concerns primarily the presence or absence of involvement of the eighth nerve. Lesions may occur within the inner ear, in the acoustic end-organ, the cochlea, or the auditory nerve or its central connections. Costen noted, in his series, that there were cases in which the deafness was due to coincident nerve involvement. These cases naturally did not improve after inflation of the eustachian tube nor after repositioning of the jaw.

In the investigation of deafness, the first step is to determine whether the defect in hearing is due to an extraneural disease process in the middle ear or to nerve involvement. Tuning fork tests are commonly employed as a preliminary measure. Information obtained by these tests should be followed by more accurate

examination with the audiometer. The two fork tests most commonly used are the Rinne and Weber tests. Normally, air conduction is greater than bone conduction. A vibrating tuning fork is held on the mastoid bone and the patient hears a hum. After a certain period of time, the hum will no longer be heard. If the fork is then held in front of the external auditory canal, the hum is audible again. In middle ear disease or obstructive deafness, the sound is not heard when the fork is held in front of the ear; that is, bone conduction is greater than air conduction. If both air conduction and bone conduction are lost, the deafness is nerve deafness. This is the Rinne test.

The Weber test consists of placing a vibrating tuning fork on the vertex of the head. Normally, the hum is heard equally in the two ears. In middle ear disease, the sound is referred to the bad ear.* In nerve deafness, the sound is referred to the good ear.

Lesions of the eighth nerve may present, in addition to defective hearing, other signs and symptoms which enable us to place the lesion. In the end-organ, equilibration may be simultaneously affected. Tinnitus is a frequent accompaniment of eighth nerve disease. There may be a constant buzzing in the ear, or shrill whistling noises. Usually, the tinnitus of nerve involvement is high pitched in contrast to that of middle ear deafness, which is low pitched, often bubbling in type. Vertigo or dizziness likewise may be present. Objectively, nystagmus is usually elicited when the labyrinth or retrolabyrinthine structures are involved. At times, these symptoms may appear in recurrent severe attacks, in which vomiting usually accompanies the tinnitus and vertigo and the patient may become very unsteady, and not infrequently falls. Such a syndrome is known as Meniere's disease and is due to involvement of the labyrinth. The eighth nerve intracranially is in close relationship to the seventh nerve and therefore an associated facial weakness on the same side as the deafness would call attention to this location. Tumors arising from the eighth nerve, the so-called acoustic neurinomas, or other tumors in the cerebellopontine angle may give rise to tinnitus and deafness as early symptoms. Later, involvement of the facial nerve becomes manifest through spasm or weakness of the facial musculature. This is followed by disturbance in equilibration, the patient showing an ataxic gait or incoordination of the upper extremities.

The auditory nerve may be injured by fracture of the base of the skull. It may also be the seat of a neuritis of either infective or toxic origin. Influenza may be followed by deafness, usually bilateral. Syphilis occasionally produces symmetrical auditory neuritis, with total deafness, sometimes accompanied by facial paralysis.

Tinnitus and disturbed hearing may also be central in origin. Central tinnitus is more complex, taking the form of elaborate noises or music. An auditory aura is frequently encountered in epilepsy and in lesions of the temporal lobe.

From the neurologic point of view, there is no indication that the eighth nerve is involved in temporomandibular disorders. Whether the ear symptoms can be produced by the alleged encroachment of the condyle on the eustachian canal or tympanic structures is a question in which the otologists should share. The use of the audiometer in clinical work is being encouraged and should give more accurate data in cases of deafness. There is no record of such tests being performed in Costen's series. He apparently relied on the tuning fork tests and the subjective responses of his patients. This type of data is hardly sufficient to verify his statements as to the severity of the deafness and the improvement following the repositioning of

the jaw. In the literature,[30] it appears that many otologists do not agree that the artificial correction of the bite accomplishes the relief of deafness or tinnitus. It is apparent that more accurate data are needed to clarify this issue.

GLOSSODYNIA

Glossodynia, or painful tongue, is suggested as a characteristic symptom of temporomandibular disorders. This complaint is entirely subjective and not associated with any gross visible changes in the tongue. In Costen's[31] complete series of 165 cases, thirty-three presented this symptom. All except four patients were entirely relieved by repositioning the jaw.

The term glossodynia was introduced as early as 1854 by Buisson[32] to designate the condition of painful or burning tongue. Since then, it has been used by various authors in describing this symptom, which may occur in many disease syndromes. At the present time, a concept of the nature of glossodynia must take into account the presence or absence of demonstrable disease of the tongue. The existence of cases of painful tongue in which careful examination failed to reveal any local or general positive physical manifestations naturally led to the conclusion that the complaint was functional. The observation that patients with this complaint were obviously of a neuropathic disposition led Oppenheim[33] to write in his textbook of neurology,

> . . . glossodynia—a paresthesia, particularly a burning and prickling sensation on the tongue extending perhaps to adjacent membranes. It may be continuous and paroxysmal and may even disturb the sleep. It has been observed particularly in women of advanced age, but is not very common. The teeth were almost always absent. A neuropathic disposition is generally present. A gouty diathesis may also tend to cause it and cancerophobia is often present. Often it cannot be decided, however, whether hypochondriasis evoked the paresthesias or vice versa. Nothing is found on examination.

More recently, Gilpin[34] reported a series of forty-eight cases with glossodynia observed at The Mayo Clinic. These were cases in which no positive physical disorders could be uncovered to explain the symptom. Thirty-seven of the patients were women, three-fourths of them being more than 50 years of age. Thirty-seven patients complained of various functional disorders in addition to the glossodynia. Of these, ten gave a history of migraine. The percentage with mental depression and hypochondriasis was somewhat higher than in the general population. Eight of the forty-eight had cancerophobia, two syphilophobia and one the fear of pellagra. The condition of the teeth was noted carefully and it was found that twenty of the forty-eight had lost all or many of their teeth, twelve being completely edentulous. Only occasionally, a carious or pulpless tooth was found at examination. The facts presented in Gilpin's series naturally support the contention that there is a group of cases of glossodynia in which a diagnosis of neurosis seems justifiable. The fact that a cure was accomplished in many instances by the judicious use of psychotherapy supports such a conclusion.

Glossodynia without objective signs may occur also as a symptom of certain nutritional or metabolic disorders. In pernicious anemia, pellagra and sprue, burning tongue may be one of the earliest complaints and, in many instances, especially in the early stage, the tongue may appear perfectly normal. Later, however, the tongue may become reddened, particularly on its edges, and the mucous membrane be covered with enlarged, reddened or purple papillae. At a later period, these areas may become denuded and a smooth glossy condition of the tongue result. This is particularly true of pernicious anemia. In sprue and pellagra, ulceration of the tongue mucosa suggests dietary and gastro-intestinal disturbances.

There have been many theories pro-

posed to explain the paresthesia of glossodynia. The presence, in many instances, of hyperacidity of the gastric juice led to the hypothesis by Sellei[35] that the pain is reflex, the impulse going from the stomach by way of the vagus nerve to the nucleus in the floor of the fourth ventricle, and thence to the nucleus of the fifth nerve to the tongue. But there are just as many cases of glossodynia in which hypoacidity is found, and indeed also a large group with normal gastric acidity.

We all are familiar with the painful condition of the tongue produced by the simple accident of drinking very hot soup or beverages. As a result, a mild inflammation of the mucosa occurs and enlarged reddened or purple papillae may be visible. The sensory nerve endings conducting pain are thereby rendered hypersensitive, and burning sensations may now result from agents such as fruits or sweets which formerly evoked mild and pleasurable sensations. A similar condition may result from mechanical trauma due to the presence of rough teeth or improper dentures. From a physiologic standpoint, a neuritis of the peripheral nerve endings has been produced. Thus it has been proposed that the "painful tongue" of pernicious anemia is due to the fact that, with the denuding of the mucous membrane resulting in classical smooth tongue, the atrophy of this covering renders the nerve endings more accessible to stimulation by germs or by mechanical irritation. This cannot be the explanation, however, as the most painful tongues are seen in cases in which there is little or no atrophy whatever of the mucous membrane.

Atrophy of the tongue has been reproduced experimentally in rats on a vitamin B deficient diet.[36] The use of vitamin B in the treatment of glossitis has frequently had favorable results. Combined with liver therapy, it has proved helpful in relieving this symptom in pernicious anemia.

The dental profession is familiar with the idea proposed by Lain[37] and by Rattner[38] that burning of the tongue may be the result of electrogalvanism produced by the presence of dissimilar metals in the mouth.

Costen's explanation[39] for the occurrence of glossodynia in temporomandibular disorders as noted is a theoretical assumption. He has assumed that compression of the auriculotemporal nerve by the condyle of the mandible gives rise to referred pain along the mandibular nerve to its lingual branch and hence to the tongue. The fact that repositioning of the jaw gave relief from this symptom in a majority of the cases apparently would seem to lend support to such hypothesis. This is not proof, however, that burning and painful tongue is due to compression of the auriculotemporal nerve. The literature is replete with bald statements and hypotheses concerning the causation of particular symptoms, but, from a scientific point of view, such theories are of little value unless substantiated by experimental facts. If compression of the auriculotemporal nerve is responsible for the glossodynia, severance of this nerve from its connections with the mandibular branch of the trigeminal nerve should stop the pain. Until such an exact experiment on the human being is performed, this explanation cannot be held valid. It may be recalled that Dean[40] and Sluder[41] wrote of relief from glossodynia by cocainization of the sphenopalatine ganglion. Non-critical persons may readily accept attractive explanations, even though they are only theoretical, and, as a result, misguided plans of treatment make their appearance.

When glossodynia does occur in cases in which there is present pathologic conditions of the temporomandibular joint, one should carefully consider and rule out all other possible causes for painful tongue before concluding that it is a symptom due to this arthropathy.

The mucous membrane of the tongue, particularly the anterior tip and the edges, is sensitive, and human beings are apt to pay considerable attention to stimuli arising therefrom. The alleviation of glossodynia which is reported as following repositioning of the jaw may be related to other conditions. Greene[28] has noted that "the improvement that occurs in the general health, mental attitude and expression as well as the adjacent tissues is so marked in patients who have been treated for this joint disturbance that a more vital factor must be involved than that created by changes in form of either bone or muscle tissues."

INVOLVEMENT OF THE AURICULOTEMPORAL NERVE

It may be seen that to involvement of the auriculotemporal nerve has been attributed a great many of the symptoms of the temporomandibular disorders. The symptoms have been interpreted as reflex or referred phenomena secondary to irritation of this nerve, which is located close to the mandibular joint. Clinically, there is a syndrome which results from injury to the auriculotemporal nerve. This occurs as a sequel to penetrating wounds, suppuration or surgical incisions in the region of the parotid gland which sever the auriculotemporal nerve. As a result, there is produced an area of anesthesia over the temple and preauricular region. Later, however, if the nerve regenerates, an interesting group of symptoms appear. On tasting of food, this area of anesthesia becomes reddened and covered with perspiration. Occasionally, pain also is experienced in this region. The syndrome was first described by Lucy Frey[42] in 1923. Since that time, several cases have been reported, especially in the European literature. In this country, Bassoe[43] reported two cases in 1932. In 1936, Needles[44] called attention to the treatment of this syndrome by irradiation of the parotid gland. The auriculotemporal nerve arises by two roots from the mandibular branch of the trigeminal nerve. It runs backward beneath the external pterygoid muscle to the medial side of the neck of the mandible. Thence, it ascends with the temporal artery between the external ear and the condyle of the jaw. The nerve then passes through the parotid gland to reach the skin over the temporal region and over part of the auricle and the parotid gland. Before it reaches the gland, it receives a branch from the otic ganglion, which, in turn, through the small superficial petrosal nerve and tympanic (Jacobson's) nerve, is connected with the glossopharyngeal nerve, and supplies secretory and vasodilator fibers. The auriculotemporal nerve also receives connections from the cervical portion of the sympathetic trunk with vasodilator fibers destined for the subcutaneous arterioles and secretory fibers for the sweat glands. Finally, the facial nerve supplies anastomatic branches to the auriculotemporal nerve.

Ford[45] attempts to explain the syndrome as resulting from misdirection of some of the secretory fibers of the parotid gland so that they form connections with the sweat glands and blood vessels of the skin. As a result, when a patient is eating and a volley of nervous impulses pass over the parotid fibers, paroxysmal sweating and vasodilation occur in the distribution of the auriculotemporal nerve. Apparently, such a syndrome was never encountered by Costen in his cases of temporomandibular disorders.

CONCLUSION

It has been the purpose of this presentation to consider the symptoms proposed as characteristic of temporomandibular disorders and to differentiate them from other symptom complexes with which they may be confused. In addition, attention has been called to the need for careful evaluation of symptoms and the

importance of having adequate and well-controlled data to verify one's conclusions. Although explanations may appear attractive and at first glance a proposed hypothesis may sound logical, definite proof should be presented before conclusions can be accepted as factual. This is particularly important when a plan of treatment is proposed. As a result of a more critical attitude, a great deal of misguided therapy may be prevented.

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SMOOTH AND ROUGH GREENING STREPTOCOCCI IN PULPS OF INTACT AND CARIOUS TEETH AND IN CARIOUS DENTIN

By Ruth Tunnicliff, M.D., and Carolyn Hammond, M.A., Chicago, Ill.

THE type of colony of *Streptococcus viridans* commonly isolated from the mouth on blood-agar plates is smooth, conical or convex with regular edges. It is made up of cocci in pairs or short chains. By aging, irregular marginal outgrowths from smooth colonies may be seen through a culture microscope, and by replating from this rough edge, organisms forming only rough, flat colonies with irregular margins can be stabilized. The organisms in rough, greening colonies are larger than those in smooth and appear as pleomorphic cocci in long chains and as bacillary and filamentous forms. The cocci in smooth colonies are not always virulent for mice, but if a streptococcus is virulent, it is generally found to form a smooth, not a rough colony.

Colonies of *Streptococcus viridans* of the smooth type were isolated by us[1] from the outside of intact teeth and from a few of the pulps after the outside of the teeth had been sterilized. The pulps from intact teeth which contained streptococci showed no histologic changes indicating infection, and therefore the presence of the organisms was considered probably due to manipulation of the tooth during extraction, and thus of no significance.

Read before the Section on Therapeutics, Pathology and Research at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1938.

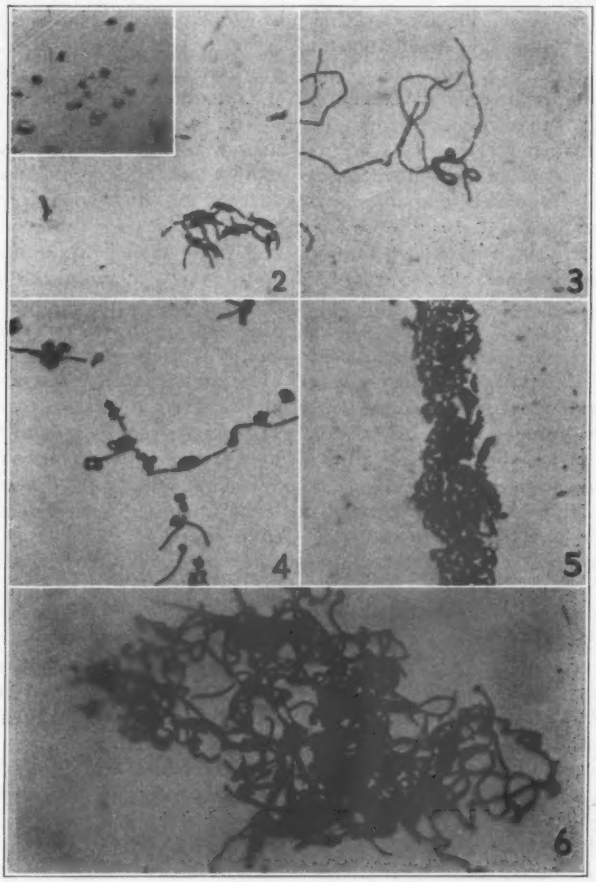
From the John McCormick Institute for Infectious Diseases and the Foundation for Dental Research of the Chicago College of Dental Surgery.

We have now made cultures from six infected pulps and specimens of dentin from six carious teeth and from a tonsillar crypt and saliva from two mouths free from carious teeth.

Extracted teeth were scrubbed with soap and water, dried with sterile gauze and cracked in a sterile vise and the infected pulps removed aseptically. No antiseptic was used on the tooth because it had been found that if caries extended to the pulp, the bacteria were killed by strong antiseptics.

Cultures from carious dentin were made by first removing the superficial decayed material, and then, by means of a sterile excavator, removing small pieces of leathery dentin from the depth of the cavity.

Smears of pulps showed signs of infec-



Figs. 1-6.—1. Rough colony of Streptococcus viridans isolated from carious dentin; grown on blood-agar twenty-four hours. (×30.) 2-6. Bacilli, crescents, coiled forms and undulating filaments in rough colonies of Streptococcus viridans. 2, 3, 6. Twenty-four-hour growth on blood-dextrose-agar. 4, 5. Twenty-four-hour growth on malt extract agar. (Gram stain; ×1200.)

tion by the presence of polymorphonuclear leukocytes. Diplococci, generally associated with bacilli and filaments, were also observed in smear preparations.

Pulps and dentin were grown in 0.2 per cent dextrose-brain broth, pH 7.0. Cultures of dentin were also made on sheep blood-agar. Subcultures from brain broth were made on blood-agar after from three to eight days' incubation at 36° C.

Under a culture microscope, greenish flat granular microscopic colonies (2 microns in diameter [Fig. 1]) with irregular margins, often with filamentous projections, were isolated four times, and slightly larger, rough colonies were isolated five times from pulps and dentin of carious teeth. No microscopic colonies, but granular conical colonies with lacy edges were isolated from one pulp. Rough cultures were, therefore, isolated from ten of the twelve specimens from dental caries. The roughest colonies were not found in cultures made directly on blood-agar plates, but in subcultures from dextrose-brain broth, perhaps because the brain broth furnished a slightly anaerobic medium. Rough colonies appeared generally only after forty-eight hours' incubation. Sometimes, greening was delayed from twenty-four to forty-eight hours.*

With the exception of cultures from one pulp, smooth colonies of *Streptococcus viridans,* some depressed in the blood-agar, and occasionally a few anhemolytic streptococcus colonies were also isolated from pulps and dentin. Once, a hemolyzing streptococcus producing a colony depressed in blood-agar was isolated also from a hemorrhagic pulp.

Similar smooth, greening colonies, but no rough colonies, were isolated from the outside of non-carious teeth and from the tonsillar crypt and saliva from caries-free mouths.

Rough colonies isolated from pulps and dentin from carious teeth (Figs. 2-6) were made up of bacilli (Fig. 2), often in palisade arrangement, crescents (Figs. 4, 5), coiled forms (Fig. 3), straight and undulating filaments (Fig. 6) and chains of bacilli containing an occasional coccus form in the chain. Cocci in pairs or short chains (Figs. 9, 10) were found in the smooth colonies (Fig. 11).

The organisms in both rough and smooth colonies are gram-positive, nonmotile and bile insoluble and are not virulent for either young rabbits or mice.

R→S→R CHANGE

Rough colonies containing bacillary, coiled and filamentous forms were changed to smooth colonies made up of diplococci by transferring in 1 per cent dextrose broth every two or three days until streptococcus forms appeared, usually after from three to twelve transfers. It generally required about three months to obtain a stabilized smooth culture.

Rough cultures have been dissociated from smooth colonies isolated as such from areas of dental caries and from caries-free mouths, and from smooth colonies changed to smooth from rough colonies from dental caries by growing them in from 5 to 20 per cent dextrose broth from three to six days and subculturing and aging on blood-agar or tomato-agar pH 5.0. These rough colonies were stabilized into microscopic rough colonies with the same morphologic forms seen in the rough colonies isolated as rough.

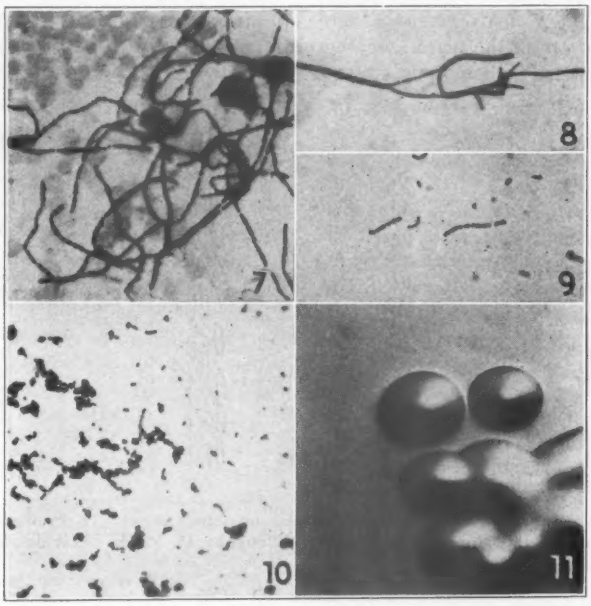
It appears, therefore, that if the rough colonies changed from smooth colonies of *Streptococcus viridans* commonly present in the mouth become sufficiently rough, they are found to be made up of crescents, coiled forms and undulating filaments as well as bacilli and straight filaments.

No greening rough colonies were isolated from the carious dentin of a 19-

*A more complete description of the smooth and rough greening streptococci from dental caries will be published in the Archives of Pathology.

year-old girl whose teeth contained fifteen carious cavities, but no fillings, the condition indicating active caries. The infection may have been so acute that there was not time for the change of the smooth culture to the rough.

The streptococcus forms observed by McIntosh, James and Lazarus-Barlow[2] and by Bunting and Palmerlee[3] in their cultures of *Bacillus acidophilus* were probably from rough colonies of *Streptococcus viridans,* which might be confused with colonies of lactobacilli.



Figs. 7-11.—7. Chains of large pleomorphic cocci in R→S change; grown twenty-four hours in blood dextrose broth. (Giemsa stain; ×1200.) 8. Chain of bacilli and cocci in colony changing form R→S; twenty-four-hour growth on blood-dextrose-agar. (Gram stain; ×1200.) 9, 10. Short chains of cocci and diplococci in twenty-four-hour-old smooth colonies. (Gram stain; ×1200.) 11. Smooth colony of Streptococcus viridans changed from rough. (×30.)

pH DETERMINATIONS

Both rough and smooth strains grow in 1 per cent dextrose, pH 4.4-5.0, and may live in this acid medium one week or more.

Rough strains growing from twenty-four hours to five days in 1 per cent dextrose broth, pH 7.0, give pH determinations of 5.2-6.0, whereas the smooth strains after twenty-four hours' growth show pH 4.4-4.8. Smooth cultures,[4] with their high acid production dependent on the amount of dextrose in the medium,[5, 6] prevent the formation of the human fibrin clot, whereas rough cultures with their low acid production have no such effect. The inability of smooth cultures of acid-producing *Streptococcus viridans* to clot human fibrin may play some part in their invasiveness since the formation of a fibrin clot is known to be an important factor in prevention of the spread of streptococcic and other organisms. Madison and Snow[7] have found that tincture of iodine 1:3,000 renders fibrin less susceptible to liquefaction by hemolytic

streptococci. We therefore tried this dilution of tincture of iodine with smooth cultures of *Streptococcus viridans* and found that, with suitable smooth strains, tincture of iodine caused coagulation of fibrin by decreasing the acidity of the culture and producing some S→R change.

Two specimens of carious dentin and saliva from two mouths free from dental caries were cultured in 1 per cent dextrose broth, pH 5.0, the medium used for growing *Bacillus acidophilus,* and subcultured on blood-agar. Large numbers of smooth colonies of *Streptococcus viridans* appeared on all the plates, together with an occasional anhemolytic streptococcus colony. Cultures from carious dentin also showed smooth colonies of *Bacillus acidophilus.* This experiment shows that acid dextrose broth does not prevent the growth of greening streptococci in cultures made direct from material from the mouth, and the results are in accord with the findings of Tucker[8] and of Anderson and Rettger,[9] who isolated streptococci of the viridans type on "pH 5.0 agar plates."

Three strains of *Bacillus acidophilus* from the American Type Culture Collection and one isolated by us from carious dentin were compared with strains of anhemolytic and greening streptococci from carious teeth. Only after from three to six days' incubation in 1 per cent dextrose broth was as much acid produced by lactobacilli as was formed in twenty-four hours by smooth strains of greening and anhemolytic streptococci (pH 4.4-4.8).

On blood agar, the colonies of both *Bacillus acidophilus* and anhemolytic streptococci were smooth and generally produced greening after from three to four days' growth. It was necessary to stain the organisms from these slowly greening colonies to determine whether they were bacilli or cocci.

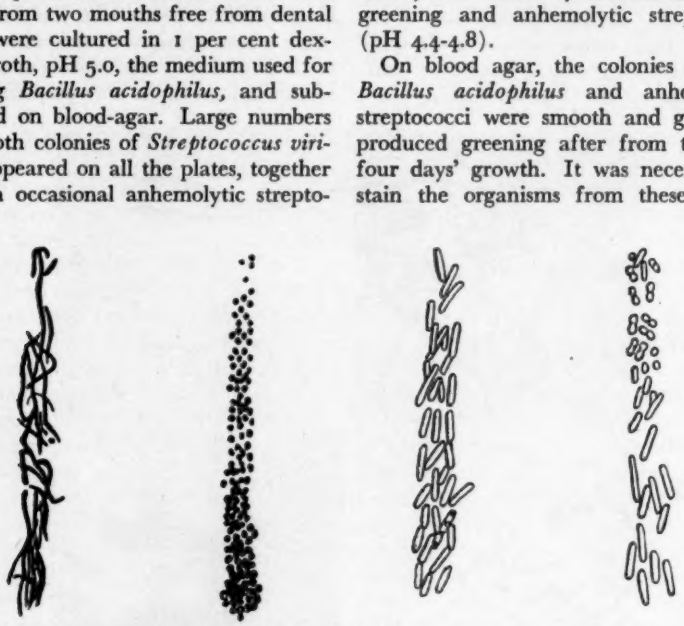


Fig. 12.—Drawing showing bacteria in tubules in dental caries. (Reproduced from "The Micro-Organisms of the Human Mouth," by Willoughby D. Miller. Philadelphia: The S. S. White Mfg. Co., 1890.)

The crescents and bacillary, filamentous and coiled forms in rough colonies of *Streptococcus viridans* resemble pleomorphic lactobacilli, but they differ in their acid production as previously stated. Although the bacillary forms in rough strains of *Streptococcus viridans* can be changed to streptococci after from three to twelve transfers on 1 per cent dextrose broth, no coccus forms have been ob-

served after twenty transfers of *Bacillus acidophilus*.

The early literature on the etiologic relation of streptococci to dental caries has been reviewed by Hartzell and Henrici,[10] who came to the conclusion that mouth streptococci of the viridans type must be the cause of dental caries in consideration of their constant presence, generally in pure culture, in the deep layers and in the advancing border of the carious process, their invasive power and their high acid production in carbohydrate mediums.

Clarke[11] has isolated from carious dentin an acidogenic, but not aciduric streptococcus *(S. mutans)* which grew as a bacillus in acid mediums. He has produced experimental caries with this streptococcus by daily changing the dextrose medium in order to keep a high degree of acidity and has demonstrated streptococci and bacilli in the tubules. Although this streptococcus was isolated as anhemolytic and only occasionally produced slight greening of blood-agar, it undoubtedly belongs to the viridans type, since anhemolytic streptococci eventually do produce greening. (Clawson[12] and personal observation.)

COMMENT

Bacillary, filamentous and pleomorphic coccus forms have been repeatedly shown to be associated with rough colonies of *Streptococcus viridans*. The crescents, coiled forms and undulating filaments found in rough colonies isolated from areas of dental caries have apparently not been observed before because the colonies studied were not sufficiently rough. The rough colonies previously described have been dissociated from smooth colonies and were not isolated as stabilized rough colonies except in subacute bacterial endocarditis.[13]

On account of the interest in the relation between endocarditis and other streptococcic diseases and dental infections, it is of interest that 84 per cent of the greening streptococci isolated from the blood of patients with subacute bacterial endocarditis show signs of roughness morphologically or colonially or both.[13] These observations suggest that the rough element in streptococcus cultures may be an essential factor in the production of endocarditis. The rough streptococci isolated from endocarditis[14, 15, 16] appear to correspond to the type of *Streptococcus viridans* with which Rosenow[17] produced endocarditis in young rabbits. *Streptococcus mutans*, isolated by Clarke[11] from areas of dental caries and isolated from the blood of persons with subacute bacterial endocarditis by him and by Abercrombie and Scott,[18] appears also to contain some rough element, as evidenced by the irregularity of the edge of the colony on dextrose agar and the presence of bacillary forms in acid mediums.

The observation of bacillary and undulating filaments in the greening rough colonies isolated from pulps and from dentin of carious teeth, which later changed to cocci, suggests a similarity to the illustrations (Fig. 12) of organisms in tubules of carious teeth published by Miller[19] in 1889. He observed that micrococci predominated and might be the only organism present in the tubules. Cocci mixed with rods and long "tortuous threads" were also observed in separate tubules, but might be mixed in the same tubule.

The fact that a few specimens of Miller showed only bacilli may have been due to the presence of only rough strains of streptococci as isolated from one of our specimens from carious dentin. Miller considered that the presence of three types of organisms in carious teeth was due to a mixed infection.

We examined sections from seven carious teeth and found cocci alone in those with slight caries, whereas cocci associated with bacillary and undulating filamentous forms were observed where

there was more extensive destruction of dentin. Cocci always predominated and were seen deeper in the tubules than bacilli and filaments.

There has been a lack of agreement as to whether the streptococcus or the lactobacillus is the important organism in dental caries, because of the conflicting results in the experimental production of caries by these two organisms. Since Anderson and Rettger[9] have found that oral acidogenic streptococci are as capable of causing decalcification of enamel as are oral lactobacilli, and since Maclean[20] has shown that dentin is invaded with approximately the same ease by either organism provided sufficient acid is produced, the conclusion seems warranted that the presence of either the streptococcus or the lactobacillus might cause experimental caries. However, the fact that, in natural caries, cocci are the predominating and often the only organism present in tubules indicates that the invading organism in dental caries is a coccus, whatever the predisposing factors.

SUMMARY

Microscopic greening rough colonies made up of bacilli, crescents, coiled forms and straight and undulating filaments have been isolated from pulps and dentin of carious teeth. The organisms in rough colonies were changed to cocci in pairs or short chains forming smooth colonies. Similar rough colonies with the same morphologic forms have been dissociated from smooth colonies isolated from carious dentin and from mouths free from dental caries. The rough cultures isolated from dental caries, therefore, appear to be dissociants of cultures of *Streptococcus viridans* normally present in the mouth.

Rough cultures of *Streptococcus viridans* produce less acid (pH 5.2-6.0) than smooth (pH 4.4-4.8) in 1 per cent dextrose broth, pH 7.0. Organisms from both rough and smooth colonies grow in 1 per cent dextrose broth, pH 4.4-5.0.

The organisms found in smooth and rough colonies of *Streptococcus viridans* appear to correspond to the cocci, bacilli and "tortuous threads" described by Miller in tubules of carious teeth.

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THE IMPACTED LOWER THIRD MOLAR

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In 1933, after a review of much available literature written during the preceding fifteen years on the subject of the impacted lower third molar, we presented a paper embodying the principles and technics evolved during that time and added our personal observations and experiences over a like period. Since then, the basic principles underlying third molar surgery have changed but little. In the mechanical field, however, new instruments (providing new methods) have been devised, tending to make for far greater efficiency in the surgical removal of these teeth. It is for the purpose of considering in detail the advantages and disadvantages of such a new mechanical aid, namely, the motor-driven automatic mallet, that this paper is written.

If we study the development of third molar surgery in America, we shall find it has been cyclic. Today, we find ourselves returning to the ideas and principles propounded by Kells at the beginning of the cycle more than twenty years ago. We are, however, at a much higher level as the result of the mechanical improvements which have been devised since then.

The fundamental principle underlying third molar surgery is that a sufficient aperture must be formed in the bone to permit the passage of the widest diameter of the impacted body. Kells, one of the pioneers of the modern era of oral surgery, when studying this problem, immediately realized that, by decreasing the size of the body itself, he would thereby reduce the extent of osseous destruction and its attendant trauma to a minimum. Having arrived at this sound conclusion, he found the execution of the idea no simple matter. Armed with only the burs, carborundum stones and disks of his day, he evolved a technic, quite difficult and arduous, for dividing the crown of the tooth into several component parts. These small parts could then be delivered through a comparatively small opening in the buccal wall of bone. With the crown portion of the impacted tooth thus sectionally removed, he was able to dislodge the root portion into the space occupied by the crown and thus complete the case. Although Kells' ideas and technic fell into disuse, years later they were to be "rediscovered."

With the abandonment of the attempts at tooth division, operators were faced with the problem of removing the impacted body *en masse*. Since many of these impacted teeth have very large crowns, often deeply embedded in the mandible, radical osseous reduction became necessary. Attention was therefore concentrated on the development of instruments for bone reduction that would be both highly efficient and least traumatic.

The chisel and mallet were the instruments most generally known and, at first, were the ones most widely used. Countless types of chisels and mallets adapted for special use in oral surgery were brought forward by many operators. As all are familiar with the use of the chisel and mallet for bone reduction, we shall not describe a routine chisel and mallet technic. The chief disadvantage of this technic was that slight, non-traumatic

Read before the Monmouth County (N. J.) Dental Society, February 1938.

blows with the mallet resulted in an extremely tedious and time-consuming reduction, whereas sharp malleting, although rapidly reducing the bone, was extremely traumatic. Again, surgical shock resulting from prolonged use of the mallet was occasionally observed.

The introduction of the hand chisel or ossisector was the answer to the problem of trauma from the chisel and mallet. Anatomic study and clinical observation of the third molar region had revealed that the retromolar triangle was the most vulnerable point for bone reduction. Covered by a thin layer of dense, cortical bone, the underlying osseous structure was soft and cancellated. The function of the ossisector is to penetrate this outer cortical layer distally to the impacted tooth and thus create a distal opening in the bone. The distal opening can now be rapidly enlarged with suitable ossisectors working toward and away from the impacted tooth. The yielding cancellous bone below can then be removed and an adequate distal relief be afforded in a comparatively short time. Slight buccal reduction followed by the application at the mesiobuccal corner of suitably devised elevators will now permit the distal displacement of the impacted body. For the typical mesio-angular impaction, distal displacement must be sufficient to permit the upward movement of the third molar to clear the contact point of the second molar. Removal of the tooth is effected by direct buccal application of the instrument. The ossisector and its associated technic were brought to their highest development by George B. Winter, of St. Louis, although many other men, including Parker and Woodward, have devised excellent ossisectors.

Although the advantages of the Winter technic over the chisel and mallet are apparent, there are certain disadvantages to be observed. Its successful use is predicated on the highest degree of skill in the operator. Proper diagnosis and proper selection of instruments are of paramount importance. It is well known that fracture of the mandible may follow the injudicious use of this technic. Again, the pressure necessary to effect reduction is often quite rigorous, placing a definite strain on the temporomandibular joint. Despite careful support given the jaw

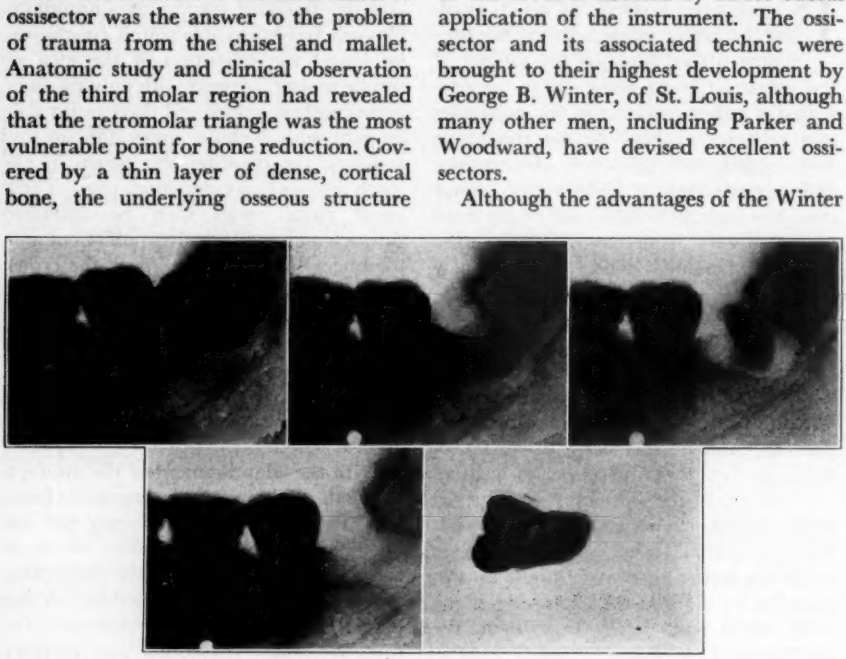

Fig. 1.—Stages in sectional removal of mesio-angular impacted third molar. In the postoperative film, it is evident that the distal bone has been untouched.

during ossisection, the patient will often complain of severe pain in the joint due to this stretching of the capsular ligaments.

The next stage of third molar surgery was the use of the surgical drill developed by M. H. Feldman, of New York. Here, we find, in certain instances, a return to some of the ideas of Kells. The surgical drill is remarkably effective in rapid bone reduction with a minimum of trauma. By shallow penetration through the cortical layer of bone followed by slight exolever movements, distal relief is quickly and effectively attained. The idea of division of the tooth into crown and root portion is here revived. Division is effected by driving the drill through the entire diameter of the tooth at the cemento-enamel junction. Repeated penetration at strategic points will so weaken the structure of the tooth at this point as to render its complete separation into crown and root portions a simple matter. Here too, however, disadvantages become apparent. In the first place, as the drill is quite ineffectual against enamel, exposure to the cementum must precede any effort at division. Again, the rapidly revolving drill generates a tremendous amount of heat, and unless the operator is quite careful, the bone will be overheated and intense postoperative distress result.

Let us make clear at this point that there was no sharp line of demarcation between these various developmental phases. We have divided them into definite categories for purposes of simplification only. In actual experience, there was marked overlapping between all these schools of thought with simultaneous development. Ideas and methods were freely borrowed one from the other, so that today we find many operators using one or a combination of several of these technics with excellent results.

With this hasty review as a background, let us consider the utility and practicability of the automatic mallet as an adjunct in third molar surgery. The mallet is a motor driven device of simple mechanism resembling in appearance the ordinary dental handpiece. It was devised by a young engineer, D. D. Levy, in consultation with many interested dental surgeons. Into the head of the mallet may be inserted a great variety of points for purposes of tooth division, bone reduction, etc. The mallet functions by automatically compressing and releasing an inner spring. Since the extent of compression is uniform, the blow delivered at the mallet head is constant. The inner springs may be varied to deliver a light, medium or heavy blow. The secret of the success of the instrument lies in the extremely short forward movement of the cutting blade, not exceeding 1 mm. The entire force of the blow is expended over this brief distance. This feature eliminates to a large degree all "follow through" effects.

To the devotee of sports, the term

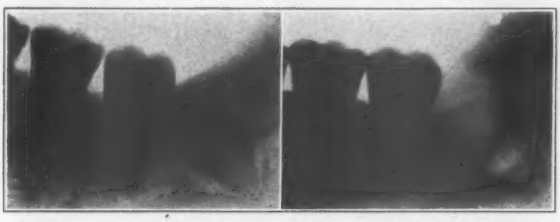

Fig. 2.—Preoperative and postoperative films of vertico-angular impacted third molar. There is no distal osseous reduction.

"follow through" needs no explanation. To others, we would define it as a continuation of the full force of the blow following impact with the object struck. Thus, in golf, the force of the blow is not fully expended until the club head is far over the left shoulder. When using the chisel and mallet, it is the "follow through" force which carries the shock of the blow far beyond the point of impact, inducing marked discomfort. A simple test divulges to what a marked extent the "follow through" has been eliminated in the automatic mallet. When a solid molar is held between the thumb and fingers of the left hand, it is possible to split the crown of the tooth in two parts with one or two blows of the mallet. Such a feat is obviously impossible when an ordinary chisel and mallet are used. The force of the blow is scarcely felt by the fingers of the left hand. It is worthy of note that the maximum force of the blow at the point of impact is from 5 to 7 pounds, depending on the spring used; whereas, with the chisel and mallet, the lightest possible blow which will effect reduction is at least 15 pounds.

Pell and Gregory have reported a similar technic for the sectional removal of third molars, using the chisel and mallet, with brief mention of the electrically driven mallet. They, however, fail to report the splitting of freely movable bodies such as the incompletely formed third molars in the young patient. Our observations have shown us conclusively that the automatic mallet is capable of sectioning such freely movable bodies.

The practical value of this instrument in third molar surgery lies in its marked efficiency at both bone reduction and tooth division. It makes possible a complete return to the ideas of Kells, but on a much higher technical plane. This can be best substantiated by a consideration of its use in typical third molar cases. The most frequent type of impacted third molar is the mesio-angular. It is common knowledge that a great number of these can be removed by simple distal displacement from the mesiobuccal angle. There are, however, a certain percentage in which the anterior border of the ramus effectually prevents sufficient distal displacement to overcome the impinging contact point of the second molar. In these cases, if undue stress is applied in an

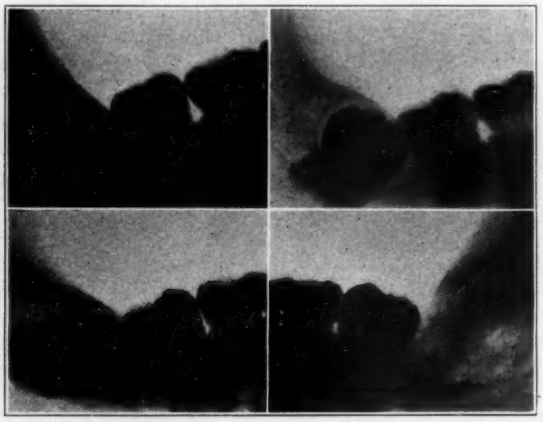

Fig. 3.—Two deep third molar impactions in one jaw. The second molars are partially erupted. Splitting was employed in removing impacted teeth.

attempt to force the body past the contact point of the second molar, injury to the second molar or, more serious, fracture of the mandible may result.

The automatic mallet is used in these cases to split off the distal half of the crown. The blows are begun at the buccal groove and are directed downward. Usually, one or two blows will be sufficient to complete the division. This distal segment is now displaced with suitable elevators. It is now apparent that a space has been created which will permit the distal displacement of the remainder of the impacted tooth. This final displacement is effected in the usual manner by application of the elevator at the mesiobuccal corner.

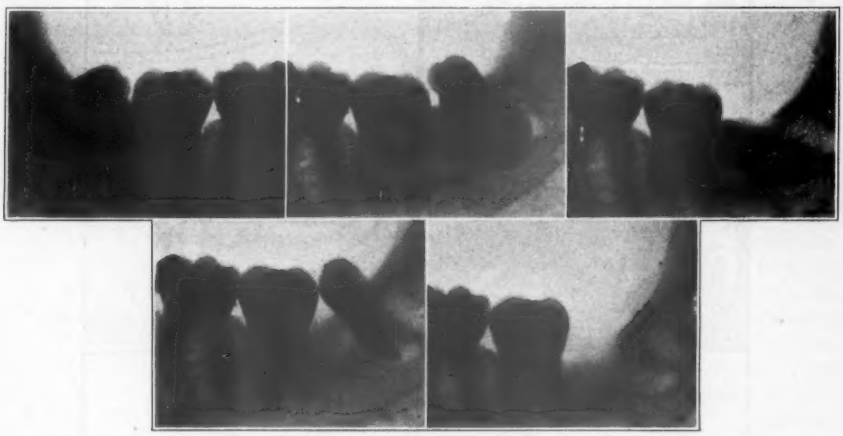

Fig. 4.—Stages in sectional removal of horizontal impacted third molar. Bone reduction was not necessary in this case.

The horizontally impacted tooth, next in order of frequency, lends itself particularly well to this technic. Any technic which requires removal of these horizontal bodies *in toto* must necessarily call for extensive buccal and distal osseous reduction. To any one who has studied these cases, it is apparent that the elimination of the crown portion of the tooth would radically reduce both the time of operation and the extent of reduction. That this has been known for many years is evidenced by the fact that Kells attempted, as many operators since his time have, to devise technics for getting rid of the crown. The automatic mallet solves this problem in the most efficient and effective manner to date. After reflection of the flap, sufficient buccal reduction is effected to expose the buccal groove of the impacted tooth. Blows directed at this groove will divide the crown into distal and mesial sections. The distal section is displaced with suitable elevators. The lower or mesial section of the crown is now attacked and its separation from the root portion is comparatively simple. Thus, in a very few minutes of operating time, we are able to eliminate the entire crown of the horizontally impacted tooth. The displacement of the roots into the space formerly occupied by the crown is not difficult and can be readily accomplished by root displacement technic. It is surprising and gratifying to discover how many of these horizontally impacted teeth can be removed with a minimum of bone reduction. We see here, then, the final completion of the cycle. The ideas embodied in this method are the ideas of

Kells, but they are carried into effect on a definitely higher mechanical and physiologic plane.

We are aware that this description of technic sounds overly simplified. The remarkable fact, however, is that, in any number of cases, we find the operation as simple as it sounds. To be sure, several months are required to master the instrument, its uses and technic. For our part, we found that we had to devise several mallet points to satisfactorily meet our particular requirements. Since the construction of the widest variety and assortment of points is possible, the adaptability of the instrument to the individual habits and customs of each operator is commendable.

We list below two situations in which the particular adaptability of this instrument is noteworthy.

1. The removal of unerupted third molars in young people prior to the formation of the roots. These solid enamel bodies, suggesting a ball and socket formation, are recognized by the experienced oral surgeon as difficult cases. The ability of the automatic mallet to

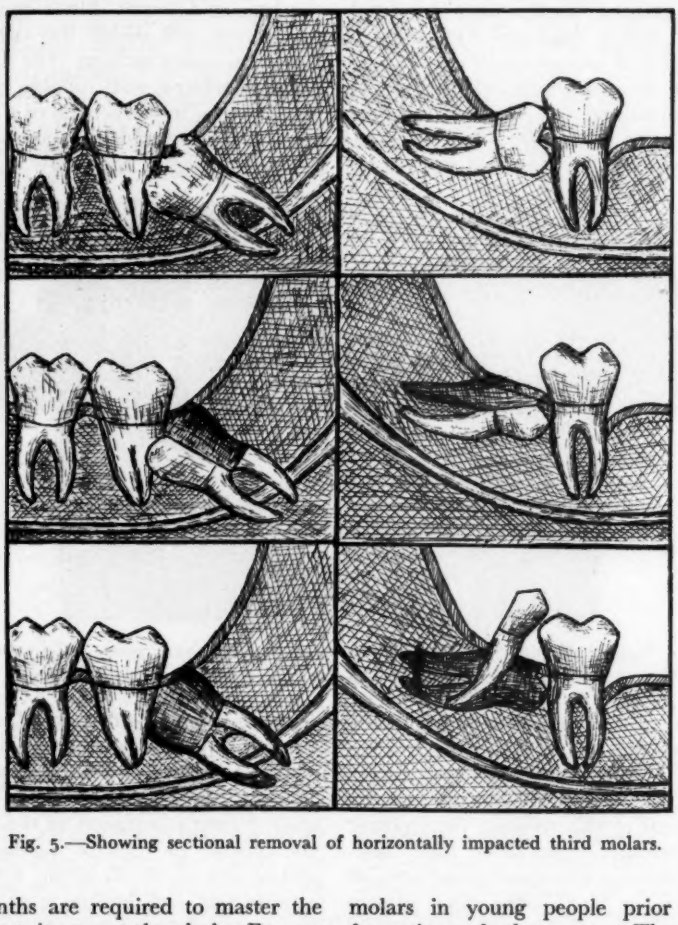

Fig. 5.—Showing sectional removal of horizontally impacted third molars.

divide these freely movable crowns into sections is of immeasurable aid in simplifying their removal.

2. The removal of a difficult horizontally impacted tooth in the presence of a weak second molar with the first molar missing. Here, the early elimination of the crown of the third molar obviates all danger to the already weakened second molar.

3. The removal of an impacted tooth lying under the contact point of a second molar carrying a large distal amalgam filling or an inlay. Sectional removal of the crown of the third molar will prevent displacement of fillings in the second molar.

The advantages of the automatic mallet then may be briefly listed as follows:

1. Elimination of almost all shock and jar incident to the use of the chisel and mallet.

2. Elimination of unreliability of the blow and poor direction observed with the chisel and mallet.

3. Marked efficiency in osseous reduction or tooth division.

4. Reduction of osseous destruction to a minimum.

5. Sharp decrease in operating time.

6. Extremely gratifying postoperative recoveries.

To our minds, the ultimate test of the superiority of one technic over another lies in its postoperative results. In our experience, postoperative results have with this technic been uniformly superior to any we have observed before. The explanation for this has several factors. Primarily, the elimination of distal reduction has a marked effect on postoperative swelling and discomfort. Although the soft cancellous structure of the osseous tissues in the retromolar triangle makes it amenable to ossisection, as was mentioned earlier, it is also true that the extreme vascularity of this type of bone results in profuse postoperative hemorrhage. Again, removal of the tooth as a unit often necessitates reduction of the bone at the distolingual corner to prevent fracture of the lingual plate. This lingual reduction is also accompanied by hemorrhage.

Another factor in preventing postoperative reaction is the diminution of osseous reduction and its associated trauma. As Howard C. Miller, of Chicago, recently stated at an Essex County (N. J.) meeting, "The tooth belongs to me, but the bone belongs to the patient." Stated thus in a single sentence is a sound philosophy of third molar surgery. By reducing bone destruction to a minimum, a train of favorable circumstances is set in motion. The areas invaded by the surgical procedure are greatly diminshed in extent, and the dangers of postoperative infection are reduced proportionately. Again, this diminution in extent of the surgical area sharply reduces postoperative hemorrhage. Finally, the elimination of extensive osseous reduction results in a sharp drop in actual operatting time.

It seems that the medical profession has been more alert to the value of rapid surgery than we have. Robert T. Morris, one of the outstanding surgeons of this century, recently wrote an autobiography entitled, "Fifty Years a Surgeon." He describes how radically concepts of surgery have changed during his lifetime. We should like to quote a short but pertinent paragraph from this book.

> A patient usually retains a great fund of natural resistance during the first fifteen minutes of an operation, no matter what is being done. He is usually depressed after an hour of operative procedure, no matter what is being done. It seems well, therefore, for us to attempt to keep within the fifteen minutes wherever possible.

The tendency among teachers and many leaders of our profession today is to stress technic and ignore the time factor. Since the perfection of local anesthesia technic, the profession has been led to believe that the element of time is unimportant. "Take your time," "Op-

erate slowly" have become the slogans of a considerable number of oral surgeons. As a result, many patients are kept in the operating chair for an hour or even two, all in the name of "careful" operating. We are wholly in accord with Morris that long-drawn out operating sessions tend to break down the natural physiologic resistance of the patient and have severe and debilitating postoperative reactions. Let us hasten to add that we are not advocating a return to the old days of "rip and tear" oral surgery. Rather, we urge a complete knowledge of modern technics, to be applied in conjunction with the skill and dispatch possessed by many of these earlier operators. No waste motion, no unnecessary procedures, no useless handling of tissues: these are the dicta which make for excellent postoperative results. The automatic mallet, because it reduces operating time to a minimum by eliminating extensive bone reduction, is, in our opinion, the explanation of the remarkable postoperative results attending its use. We are in a position to state that no impacted third molar, regardless of classification, should require more than thirty minutes of operating time with this technic.

Although we believe this to be the best technic yet devised for third molar surgery, there are certain disadvantages to be considered. In the first place, splitting of the enamel and reduction of bone are often accompanied by flying chips. The danger that such fragments may fly back and be inspired must be constantly borne in mind. A throat curtain should always be in position during this procedure. In the second place, one loses the sense of "feel." To the operator accustomed to working with hand pressure ossisectors, this loss of "feel" is a real disadvantage. Finally, overenthusiastic application may drive a fragment of the tooth either into the mandibular canal or more probably through the lingual plate of bone into the soft tissues of the floor of the mouth. These disadvantages must be borne in mind by the careful, conscientious operator.

It is our opinion that here is a new instrument which radically alters third molar technic. We believe that this new technic is superior to anything yet developed and is worthy of the closest study and consideration.

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THE ARTHRITIS PROBLEM AND ITS RELATION TO THE DENTIST

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ANY consideration of arthritis must begin with a few words about classification. In general, there are two large divisions. Infectious arthritis makes up one of these groups. It may be subdivided into specific and nonspecific types. Specific infectious arthritis includes all those cases in which the etiologic organism is definitely known; that is, cases caused by such organisms as the staphylococcus, meningococcus and pneumococcus, *Bacillus typhosus* and *Bacillus tuberculosis*. The occurrence of these forms constitutes a complication to some disease and represents a metastatic invasion of the joint, characterized by acuteness and by destructiveness. From the standpoint of the dentist, the only importance of the specific infectious types of arthritis lies in the need to differentiate them from the non-specific forms.

Non-specific infectious arthritis makes up a large group of cases. From the terminology, it becomes evident that it is considered infectious, but that there is some doubt as to the identity of the infecting organism or how it operates. Moreover, it must also be admitted that the evidence supporting the infection theory is not entirely convincing. There are, therefore, a large group of students of arthritis who either completely deny the infectious etiology or at most only tolerate it.

Osteo-arthritis makes up the other large division. This type occurs chiefly as the result of degenerative changes and apparently bears no relation to infection. Unfortunately, non-specific infectious arthritis and osteo-arthritis may occur in the same patient, thereby confusing the diagnosis as well as the treatment. It is with the non-specific infectious arthritis, osteo-arthritis and the mixed type that the dentist is most concerned.

DIAGNOSIS

The first problem to solve in a case of arthritis is diagnosis of the type, since, without it, evaluation of the infectious element is impossible, and treatment may be irrationally prescribed. It seems only just, then, that the dentist called on to treat arthritis should first be aware of the type. This can best be accomplished by cooperation with a physician; but, on the other hand, the dentist should be entirely within his rights if he insists on knowing the diagnosis when a patient is referred to him by a physician. Only by such cooperation can the professions profit and the patient be wisely treated.

Non-specific arthritis usually occurs in persons between 20 and 40 years of age. In children, the condition, called Still's disease, may result in serious deformity. Persons over 50 years are not entirely immune, a relatively small number of cases being seen in the older age groups. These, however, are apt to be of the

(Read before the Section on Medical Relations at the Seventy-Fourth Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1938.)

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mixed type and difficult to diagnose or at least to evaluate. The onset may be acute or subacute, mild or severe. In the acute form, there is swelling, redness and pain involving one or more joints, particularly the ankles, wrists, shoulders, spine and proximal interphalangeal joints. The phalangeal joints are quite often distinctive. A fusiform swelling is accompanied by redness, increased heat, tenderness on palpation and pain on movement. There is a tendency for the joints to be involved symmetrically and at different times. In other words, the condition tends to migrate from one joint to another, one possibly clearing up before the next is involved. Not all joints are equally involved. Usually one or two are more seriously affected than others, and these are the last to clear up. The temperature may reach 101° to 102° F. The acute stage lasts from two to three weeks and gradually subsides.

In the subacute and mild types, the onset is rather insidious, with fleeting joint pains that may last from only a few hours to a day or two. There may be no obvious swelling about the joints. As a rule, these patients are up and do nothing about their arthritis until struck down by a more severe attack. Many never get any worse, but have intermittent attacks of mild joint pains. In the severe forms, the patient usually gets well. A few never have another attack, whereas others have repeated attacks, with shorter intervals between them, and may become arthritic cripples. A small group of patients seem to progress from the first attack, the patient becoming a hopeless cripple in a few years.

Some of the protean manifestations of this infectious arthritic syndrome include involvement of tendons, muscles, joint capsules, nerves and even skin. Although not actually involving the joints, these syndromes have the same significance and call for the same type of management. The spine may be the only part of the osseous system involved. This type is apt to be very painful, because of the nerve root involvement, and to be rather progressive and produce much disability and deformity. The joint cartilages are often destroyed, with bony ankylosis and a resulting poker spine.

Roentgenograms are helpful in diagnosing non-specific infectious arthritis. There is narrowing of the joint space, together with rarefaction of the bone adjacent to the involved joint.

Of particular value in the diagnosis of this type of arthritis is the sedimentation rate of the red corpuscles. It is usually rapid as compared to that in osteoarthritis, in which the sedimentation rate is normal.

Osteo-arthritis is prone to occur in persons over 50 years of age and in those who, because of their occupation or build, have traumatized one or more joints. It is not related to infection. Women are somewhat more frequently affected than men. The onset is insidious and the symptoms are mild. The weight-bearing joints are frequently involved, particularly the knees. Stiffness of the joint, particularly after resting or on arising in the morning, is often the presenting symptom. Pain is usually not so severe as in the infectious type. Grating and creaking in one or more joints are frequently noted.

Particularly characteristic of this type of arthritis is the gnarled terminal interphalangeal joints. This deformity results from growth of cartilaginous or bony spurs from the margins of the joint cartilage. The degree of destruction to the joint surface is usually less than in the infectious type, and bony ankylosis never occurs. This type of arthritis is frequently seen in the spine. It may be symptomless or produce symptoms only after some minor trauma. One is often struck by the disproportion between the x-ray evidence of advanced changes and the relatively mild symptoms. On pal-

pating these joints, particularly knee, shoulder or elbow, a grating sensation is often felt. The characteristic features of osteo-arthritis are, then, late insidious onset, relatively mild symptoms, involvement of the terminal interphalangeal joints or the weight-bearing joints, grating and the absence of the usual signs of infection, namely, heat and redness.

ETIOLOGY

The diagnosis established, attention should be directed to the etiology. There seems little doubt that these patients fall into a rather distinctive group. Their hereditary pattern is bad. Usually, they are from a stock in which chronic arthritis in one or more of its manifold forms has been present. They are likely to manifest vasomotor instability, with a cold clamminess of the hands and unstable blood pressure and pulse. Gastro-intestinal symptoms are not uncommon. In addition, there is often emotional instability, and the patient may appear to fall into the large class of neurotics. The osteo-arthritic patient is likely to present other signs of degeneration, particularly arteriosclerosis, with its frequent cardiac complications. In dealing with an osteo-arthritis, a search should be made for possible trauma or strain on the affected joints. Overweight and deformity have a marked effect on weight-bearing joints. Occupation may be a clue to trauma. Weakness of one group of back muscles with compensatory activity of those on the opposite side, perhaps from an old, unrecognized poliomyelitis, may be a factor in spinal osteo-arthritis. In non-specific arthritis, diligent search should be made for a focus of infection.

A focus of infection may be defined as a localized area of infection which is capable of producing effects in remote parts of the body. Obviously, foci may be manifold. They may be large or small, single or multiple. They may themselves produce symptoms or they may be entirely quiescent. They may harbor one organism or a number of organisms. They may be primary or they may themselves be secondary to still another focus. The sites, number and character of foci may, therefore, be quite bewildering. By virtue of time and experience, certain localities have been considered likely to harbor foci of infection. These include, somewhat in the order of their prominence, the tonsils, the pharyngeal lymph tissues, the periapical regions of the teeth, the prostate, the uterine cervix, the sinuses, the lungs, the gallbladder, the colon and the gingiva. Why one of these areas should be more likely to produce remote symptoms than the others seems to defy reason.

The manner in which these foci produce remote conditions is still in the realm of speculation. One view is that, from time to time, organisms escape from the focus and are carried by way of the blood stream to remote places, such as the joints. Here, they set up secondary areas of activity, resulting in an infective type of arthritis. But if this is true, why is it so difficult to recover the organisms from the affected joint? Another view holds that the toxins formed at the focus escape into the blood stream and are carried to remote areas, such as the joints. This theory satisfies the fact that these joints are usually sterile, but fails to explain the selective activity of the toxins. Obviously, it may be argued that the toxin affects all tissues, the joints alone showing obvious symptoms. This explanation fits in well with the present conception of arthritis as a generalized systemic disease.

Still another explanation is based on allergy. The patient is first affected by the presence of an organism, which creates an allergic hypersensitive state in the joints. On reinfection with the same organism, either from the outside or from a focus, the joints react to produce what is called infectious arthritis, but which in

reality should be called an allergic arthritis. The main point in favor of this theory is the resemblance of acute, nonspecific infectious arthritis to the joint manifestations of serum sickness, which is a known allergic condition. Against this theory is the fact that allergic joints clear up without residual joint damage, whereas infectious arthritis does not. Since patients are not subjected to repeated doses of serum over long periods of time, it is probably unfair to compare residual findings in a known allergic joint with those in an arthritic one. Certainly a joint affected from a focus may be subjected to repeated assaults.

Rosenow believes that these foci contain bacteria with definite organotropic properties. By that, he means that certain foci will harbor bacteria that have a selective affinity for joints, for the stomach or duodenum, for the kidney or for the iris. Thus, he maintains that organisms, removed from a focus supposedly producing an arthritis, will, in an experimental animal, lodge in the joints, when injected intravenously. It is thus apparent that the exact manner in which a focus of infection is responsible for producing arthritis is not known, and one can therefore comprehend the reasons for the division of opinion regarding the relation of infection and so-called infectious arthritis.

There is little doubt that teeth play a large rôle in foci of infection. How the foci arise is not always clear. Dental foci include apical abscesses about vital teeth, pulpless teeth, unerupted deciduous and permanent teeth and root fragments and gingival infections. That the bone once the site of a periapical abscess may not remain a focus after the tooth is extracted cannot be denied or affirmed. Periapical abscesses about vital teeth, according to dental opinion, probably arise through dental caries. Pulpless teeth and root fragments usually show a certain amount of bone resorption, and are undoubtedly foci of lowered resistance, ready victims of a chance blood stream invasion. But where do the organisms come from that by chance invade the blood stream? These would seem most likely to originate from the body surfaces, such as tonsils, pharynx, bronchi, gastro-intestinal tract and skin.

Rosenow has experimentally proved the *locus minoris resistentiae* theory for pulpless teeth. He rendered certain teeth in dogs pulpless under as nearly aseptic conditions as possible. Bacteria were then injected into the blood stream of some and into the peritoneal cavity of others. In a large proportion of cases, periapical abscesses developed, and he was able to recover the same organism in pure culture. Such evidence seems uncontrovertible and certainly places the pulpless tooth on the dangerous list. Naturally, one cannot compare these experiments with what occurs in human beings. We are not having showers of organisms thrown into the blood stream at one time, but undoubtedly there are small numbers of organisms frequently present. The best way to answer the question is to examine the experimental work done on pulpless teeth in man. Rosenow obtained positive cultures from practically all pulpless teeth extracted immediately after death. Schaefer and Penhale obtained similar results in experiments carried out at Cook County Hospital. It thus seems that two things must be admitted: first, that pulpless teeth are foci of lowered resistance and, second, that a large percentage of them sooner or later harbor organisms. The next question that arises is how many of these teeth from which a positive culture can be obtained will show clinical or roentgenologic evidence of periapical disease. No figures are available, but it is my impression that the number would be relatively small. Again, have we any right to consider a roentgenologically negative tooth a focus of infection just because a positive culture

can be obtained from it? To this query, one can only say that there is slightly more logic to considering it a focus than to ignoring it.

Concerning gingival infections, little need be said. Unless there is actual pocketing of infection, there seems little likelihood of giving gingival infections serious consideration.

What evidence is there that foci of infection bear a causal relation to infectious arthritis? It must be admitted that a good deal of the evidence is purely circumstantial. The appearance of joint symptoms in the presence of or in the wake of a tonsillitis is so frequent as to suggest a causal relationship, and yet it cannot be definitely stated that the two are not independent. Again, the spectacular cure occasionally obtained by removing infected tonsils or a periapical abscess suggests strongly that the cause has been removed. Furthermore, from the experimental side Cecil and his coworkers have obtained considerable evidence indicating, if not proving, that infection bears a causal relationship to arthritis.

TREATMENT

After diagnosis of the type of arthritis and a study of the etiologic factors, the next problem is treatment. In osteoarthritis, since infection is not a factor, the dental job is one of preservation. The patient's chewing capacity must be preserved or improved. He will not be benefited by wholesale removal of teeth, since his nutrition will suffer, and anything that interferes with the patient's general condition aggravates his arthritis. It seems far more logical to do constructive dental work, if at all possible, than to risk the immediate shock, or malnutrition and other later effects of his inability to manage plates. If there are known foci of infection in the teeth and these are thought to have a bearing on the general condition, the removal of the teeth should be considered and, if possible, reconstruction be attempted.

In dealing with non-specific infectious arthritis, the problem is quite different. Here, the treatment of focal infection must naturally be colored by one's attitude toward focal infection as a factor in infectious arthritis.

If one believes in the theory or believes in it only in part, the treatment of focal infection must be one of eradication in all cases. If one does not believe in it, there could be no specific reason to eliminate focal infection. It seems, however, that the majority favor the infection theory and the causal relationship of foci of infection. There is never much controversy over removal of the frank apical abscess, whether it be in a vital or in a pulpless tooth. The battleground is always the symptomless roentgenologically negative pulpless tooth. There seems to be little good that can be said for the pulpless tooth. If it is not infected at the time you are considering removing it, you may rest assured that it will be in the future.

Again, if so many of these roentgenologically negative pulpless teeth yield positive cultures, how can one decide whether a particular tooth is infected? Furthermore, is there any evidence that these teeth harboring organisms, but without x-ray evidence of bone resorption, are any less dangerous? It seems that the question of extraction of pulpless teeth almost simmers down to all or none. Anything less than the removal of all pulpless teeth, if some are removed, defies reason. It is almost impossible to give a reason for taking out one and, at the same time, give a reason for leaving in another; for who knows? you might have removed the one you should have left! Therefore, in the presence of an infectious arthritis, when physician and dentist together are trying to eradicate all possible foci, honesty requires the removal of all pulpless teeth.

If a patient has had arthritis some time previously and has had no subsequent symptoms, there may be some justification for temporizing with pulpless teeth. Here, if there is much bone resorption about a tooth, as evidenced by the x-rays, it should be removed. If the pulpless tooth is roentgenologically negative, it may be left, provided the patient is made aware of its potentialities and submits to periodic x-ray studies. Should there be signs of arthritis or increasing bone resorption at any time, the tooth should be extracted.

This discussion of pulpless teeth brings up the question of trying to preserve them in the first place. Some dentists still insist that they can fill root canals and preserve teeth. It seems to me that all dentists could accomplish this in some cases, but the sad part is that there is no way of choosing these patients except by the trial and error method. What is needed is some way of foretelling which patients will tolerate a focal infection, because evidence points strongly to the probability that the pulpless tooth will become infected. In the absence of any such criteria, it must be admitted that all pulpless teeth are potential foci of infection and, in a fair number of people, will result in some remote pathologic condition, such as arthritis.

What results can be expected from removal of foci of infection in infectious arthritis? If there has been a symptomatic flare-up of a focus, just before the onset of the arthritis, and the focus is removed as soon as the acute manifestations of the arthritis are over, good and sometimes spectacular results may be expected. This is more often true when the tonsils are the causal agent, but, at times, equally good results occur from extracting an abscessed tooth. In the chronic cases of arthritis, less is to be expected. The reasons for this seem obvious. First, there is frequently present more than one focus, and all foci may not be removed. Secondly, the condition is already chronic and there are greater fixed structural changes in the joints. Thirdly, there seems little reason to doubt that the joints themselves may become their own focus. Nevertheless, removal of all possible foci is certainly indicated, if for no other reason than to lessen the amount of toxic absorption. This requires honest cooperation between physician and dentist. It will benefit the arthritic patient or the dentist little to remove several teeth if the patient is allowed to harbor a prostatic infection, which may be the primary cause of the dental pathologic condition as well as the arthritis.

Every arthritic person coming to a dentist should have a complete medical examination before his teeth are touched. Likewise, every arthritic person coming to a physician should have the benefit of good dental consultation. With dentist and physician working together, less harm may be done and more constructive help be given these unfortunate people.

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OCCLUSION IN DENTISTRY

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"OCCLUSION is the basis of the practice of dentistry." The Hall research group found this fundamental premise true in every branch of dentistry. The operator's knowledge of occlusion and the way he applies it in reconstruction work determine the success or failure of his endeavors. As occlusion is essentially the study of the movements of the mandible, I shall first analyze normal mandibular movements, and then discuss their application to the various phases of dentistry.

It is impossible to record precisely all of the movements of the mandible. The average movements of the mandible in its condylar path have been found to be as follows: 33 degrees downward and 16 degrees laterally. We find that when a stylus and a tracing plate are attached to the mandible and maxillae in such a manner that the cusps are not allowed to function, or in taking centric position for an edentulous case, the movement of the incisor point describes what is commonly known as a gothic arch. This tracing, which we call two dimensional, does not take into account the opening movement of the mandible, only the anterior and lateroposterior excursions, as there are no cusps functioning to direct the movements of the mandible up and down. The mandible retrudes to a posterior position in the glenoid fossa so that a right and a left rotation center is formed in the region of the heads of the condyles, which makes the incisor point describe the gothic arch. (Fig. 1.)

(Read at a meeting of the Northwest Side Branch of the Chicago Dental Society, November 9, 1937.)

If a stylus and a tracing plate are attached to the mandible and the maxillae in such a manner as to allow the cusps to function, the movement of the incisor point describes an arcuate tracing when held within a functional range of mastication, which is indicative of three-dimensional movement. This movement has been fully described by Dr. Hall.[1] On interpreting this tracing, we find that, unlike gothic arch or two-dimensional occlusion, the opening movement is combined with anterior and lateroposterior movements. We also find that all lateral movements of the mandible have their origin in a central rotation axis located posteriorly to the condyle chord (an imaginary line drawn through the centers of the heads of both condyles). It is because of this central rotation area that an arc is traced. (Fig. 2.) This is the true movement of the mandible when dentition is present, rather than the gothic arch.

Both the gothic arch, or two-dimensional, and arcuate, or three-dimensional, movement of the mandible and associated occlusions must be understood (Fig. 3) if we expect to get balance in our dental prosthesis, whether it be fixed bridgework or partial or full dentures, or to effect a balance to relieve traumatic occlusion in periodontia. In restorative work, checkbites can be taken in either two or three dimensions, this depending entirely on whether we intend to use cuspless or cusped teeth.

In making a two-dimensional checkbite, by use of the central bearing point, the tracing can be made either intra-orally or extra-orally, depending entirely

on the case. In full denture work, an extra-oral tracing will expedite operation; in dentulous cases, intra-oral tracings are indicated. The patient is instructed to make a chewing motion from without in, rather than from within out, when a rounded or modified gothic arch will appear. Then the patient is instructed to protrude and retrude the mandible. The point where the line formed by this movement intersects the arch is the functional centric position. (Fig. 4.) This point may be anywhere from one sixty-fourth to seven thirty-seconds inch anterior to the apex of the gothic arch. We do not consider the apex of the gothic arch as the centric position in all cases because this point marks a strained position of the condyles in the glenoid fossae. Any prosthesis built to this centric point, unless it be not strained, will either fail or be decidedly uncomfortable. Check-bites can be made for incisive or lateral positional relationships if desired.

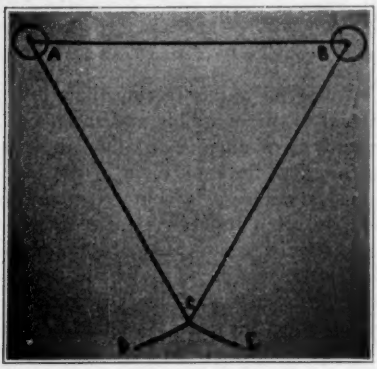

Fig. 1.—Schematic drawing demonstrating by Bonwill triangle how gothic arch or two-dimensional tracing is developed. The two rotation centers A and B will allow the incisor point C to describe only the gothic arch DCE. There is no opening movement incorporated in this tracing.

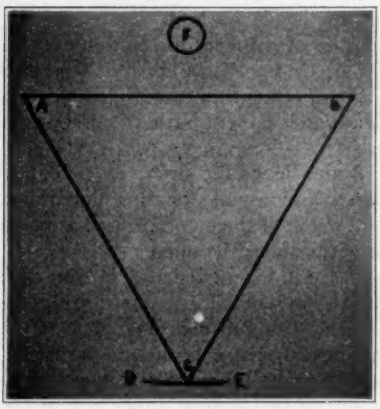

Fig. 2.—Schematic drawing showing development of arcuate or three-dimensional tracing. The rotation center F allows the incisor point C to describe the arc DCE. Opening movement is incorporated in this tracing.

Fig. 3.—Arcuate and gothic arch tracings contrasted. The great difference between the two tracings is readily discernible.

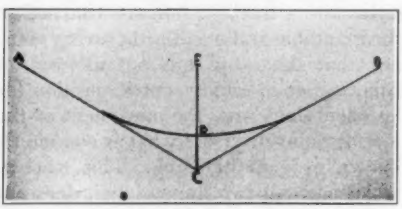

Fig. 4.—Schematic drawing of modified gothic arch (ADB). EC is the protrusive line. Functional centric position is at D, rather than at the apex C.

To get a three-dimensional tracing, we use the method suggested by Dr. Stansbery,[2] of Seattle, but modified to effect an arcuate movement. We first obtain the functional centric position, in the manner described above. Then the central bearing screw is raised sufficiently to compen-

sate for the depth of the upper first bicuspid, which is the deepest cusped tooth in the mouth. Another modified gothic arch, on which we obtain the eccentric check-bites, is "chewed in." It will be found that this second arch is always anterior to the original gothic arch on which we obtained the functional centric position. To obtain individual right and left lateral check-bites, the patient is asked to move the teeth to the side to be checked, until the teeth are in a working position. They are checked at this point, and another check-bite is obtained in a like manner for the opposite side. It will be found that a line drawn between the right and left lateral positions will pass through the original functional centric point. We are thus effecting the arcuate movement in a practical manner. (Fig. 5.) The lateral check-bites can be positioned in an edentulous case by drawing a line between the two gothic arches, making it perpendicular to a line that is drawn through the points indicating the functional centric positions.

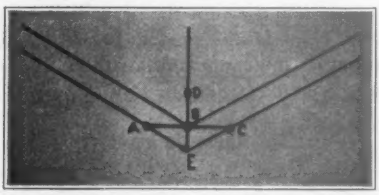

Fig. 5.—Modification of Stansbery's double gothic arch tracing. Line ABC is the practical way to obtain an arcuate tracing. B is functional centric position; A, left lateral; C, right lateral, and D, incisive position.

The selection of an articulator upon which to do the restorative work or mount the study models is very important. No articulator can simulate all mandibular movements. Few articulators can simulate correct positional relationship. In obtaining check-bites of positional relationships, we kept movement within a functional range. We have found, by investigation, that the incisor point during functional movements makes a tracing of about three sixty-fourths inch to each side of the centric point. This

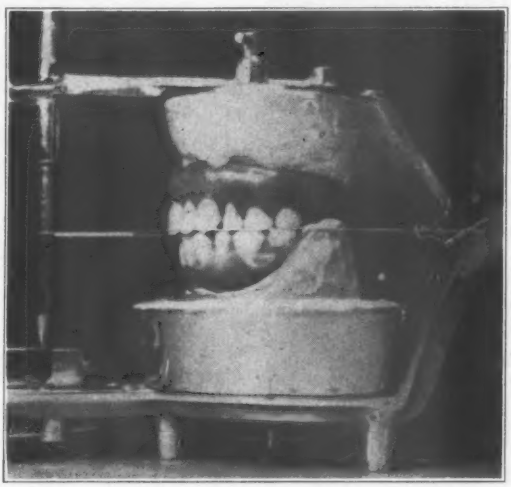

Fig. 6.—Hall's triplex articulator. Condyle paths are average and not adjustable; the occlusal plane is on the opening axis of the instrument, and positional relations are obtained by pouring metallic records.

movement is almost immeasurable in the temporomandibular joint. All articulators that are adjustable for angulation of the condyle paths can be adjusted only if excessive check-bites are taken outside the normal limits of mastication. Dr. Hall[3] shows conclusively the great discrepancy that results in the work from taking excessive check-bites. We found that there is more "play" in these adjustable articulators than there is actual movement in normal mastication in the glenoid fossa. The use of any such instrument is to be shunned if we wish to have a denture that will balance in the mouth.

Another factor that must be borne in mind in the selection of an articulator is whether it is a two-dimensional or three-dimensional instrument or both. A gothic arch articulator will not be suitable for three-dimensional work. Most articulators are two-dimensional; that is, the incisor guide pin in motion will describe a gothic arch. Only cuspless tooth restorations can be made on an instrument of this nature if we wish to be scientifically consistent. Three-dimensional or cusped tooth restoration can be made scientifically accurate only in an articulator whose incisal guide-pin can describe an arcuate tracing. The opening axis of the instrument selected should also be considered. Most investigators have found that the opening or hinge action of the jaw occurs below and behind the condyle chord.

We have found that the Hall triplex articulator meets all these requirements. (Fig. 6.) This instrument can be used as a plain line articulator; as a two-dimensional articulator for making cuspless teeth restorations, or as a three-dimensional articulator to make cusped tooth restorations.

It should be borne in mind that no articulator can in itself produce a well-balanced restoration. The operative work in the mouth has to be performed skilfully, with a full knowledge of fundamentals. No engineer would attempt to build a bridge without a knowledge of the stress and strain that it will have to resist. No dentist in the future should attempt any restoration without a full knowledge of occlusion.

SUMMARY

1. Occlusion is the basis of the practice of dentistry.

2. The gothic arch movement is shown to be indicative of two-dimensional occlusion.

3. The arcuate movement is shown to be indicative of three-dimensional occlusion.

4. Check-bites can be made of positional relationships of two and three dimensions.

5. The apex of the gothic arch is not to be considered as centric unless this position is unstrained.

6. All positional relationships should be kept within a functional range.

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"PHYSICIAN AND DENTIST": A COOPERATIVE STAND AGAINST DISEASE

By F. Howard Westcott, M.D., F.A.C.P., New York City

THE longer one practices medicine, the more convinced he becomes that the physician and the dentist can and must cooperate more fully, if they are to combat successfully the numerous common modern diseases. Dental training should be equivalent to medical education up to the point of actual specialization in the fields of practice. The end-result of this more intimate student relationship would invariably be to show us the reciprocal value of continued professional cooperation in practice and research.

These fields of endeavor are so closely linked that a campaign to eradicate infective arthritis, infective asthma, neuritis, migraine, ulcerative stomatitis and colitis, as well as stomach ulcers, gallbladder disease, nephritis and malnutrition, would be very unsuccessful without their help. A hasty survey will reveal that all of these diseases may have metabolic elements due to faulty nutrition or conditions of deficiency, as well as foci of infection, as etiologic factors.

MEDICAL COOPERATION

Under similar important conditions, the alert dentist must recognize when he needs the help of the physician. Here are some of the problems confronting him: What else can be done besides extraction for the repeated occurrence of abscessed teeth? What else can be done besides refilling for deeper and more widespread caries? Why does not stomatitis clear up and why such foul breath from a clean mouth? What is the meaning of a resistant case of trench mouth and hyperplasia? All these and many more such problems require the close cooperation and mutual trust of physician and dentist.

DENTAL RESPONSIBILITY

What do we physicians expect of the dentist when a case is referred for study and treatment?

1. A mouth either clean or in the process of being cleaned; teeth properly scaled and good clean surfaces where particles of food, millions of bacteria and tissue débris cannot accumulate with ease.

2. Healthy gums tight to the gingivae of the teeth and not soft, spongy, inflamed masses harboring spirilla, bacilli and cocci.

3. Simple but effective bridgework which fits with ease and comfort and which does not serve as a source of nervous irritability and mouth consciousness.

4. A satisfactory roentgenographic study of the mouth.

Who else is so well qualified to take and interpret dental roentgenograms as the dentist? It is indeed rare to find a commercial technician who has followed his cases to the operating chair to see whether his diagnosis of abscess is correct. Most of us learn through our mistakes, but only if we see them. Not only as an aid in diagnosis of infections, but also as a guide to bony development and growth, the dental roentgenogram can be of great help. At a recent dental medical meeting, James C. Healy, of Boston, discussed bone growth and centers of ossification as an index of normal or delayed development in children. He showed how accurately one could de-

Read before the Hartford Dental Society, January 10, 1938.

termine the development age of embryos and children by determining whether certain ossification centers were laid down. Further, the normalcy of development can be determined by comparing a child's age with his dental and bone roentgenograms. In a test for vitality when teeth are suspected, the x-rays are an invaluable aid.

5. Cultures from the apex of the teeth, when indicated, made by an approved method, because it is this portion which contacts the vascular area of the socket and its peridental membrane. The following technic as described by Henegan[1] is very satisfactory:

(a) Surgical asepsis to prepare the field. (b) The use of sterile gauze (not just clean) to surround the tooth. (c) Extraction with sterile forceps and instruments. (d) The use of a sterile curet to take culture material from the tooth apex. (e) Culturing in a well recognized laboratory.

Finally, most of us prefer the conservative dentist who is not in too great a hurry to extract teeth wholesale. Extracting many badly infected teeth at one sitting is especially unwise because:

1. It opens the portals to an overwhelming rush of bacteria into the blood stream. If the patient's resistance is below par, this may cause a bacteremia or septicemia.

2. It removes an excellent source of autovaccination. Experience shows that repeated small doses of bacteria in the blood stream, say from one or two infected sockets, act the same as vaccine therapy at its best. If extractions are spaced over several weeks in this manner, more can be accomplished than with good autogenous vaccines from the same source.

MEDICAL RESPONSIBILITY

In return, what can the dentist expect from the physician?

First, he can expect the physician to view the patient as a whole and make a thorough physical examination and clinical investigation, depending on the individual case.

This entails first a careful history dating back to the parents. Heredity plays a very important part in development. Tooth decay may be due to a poor hereditary background in about 7 to 10 per cent of children[2] as compared to 9 to 12 per cent who inherit an individual relative immunity to caries. The remaining 78 to 84 per cent are neither betwixt nor between and much can be done to provide a proper background by diet control, endocrine balance and metabolic regulation. Another way of stating this is to say that tooth development depends on the hereditary background, an adequate supply of the basic minerals (calcium, phosphorus, potassium, iron, etc.), the regulatory hormones and the vitamins.

The anlage of deciduous teeth can be demonstrated in the x-ray studies of embryos of 92 days.[3] From that time until delivery, the parent must supply all necessary nutrient materials, even to the point of self-sacrifice. Nature has endowed the embryo with power to absorb and utilize salts, vitamins and foods from parent tissues even when the outside supply has been exhausted.

In order to supply herself and the fetus with sufficient materials to build bones and teeth, the expectant mother must have an increase in these nutrients of about 10 per cent over the normal needs. It is of great importance to note at this time that adequate salts are of no avail unless enough kindling in the form of vitamins A and D is also supplied. It is a good custom to administer them together as dicalcium phosphate (1 gm.) with viosterol (units 1,000). A balanced diet is, of course, a prerequisite in these deficiency disorders.

ENDOCRINES

After birth, growth and development

are regulated by the internal secreting glands; *i.e.*, thyroid, anterior pituitary, ovaries, testes, thymus and suprarenal gland.

It is not unusual to have all of these glands normal except one, the condition of which alone can cause a general shift in equilibrium.

Endocrine imbalance is now recognized as a common disorder. Until recently, little stress was laid on minor changes, and only those cases presenting marked and advanced deficiency or overactivity were treated.

Today, the cases of toxic goiter, cretinism, hypopituitarism and giantism are infrequent as compared to the cases of mild derangement. What diagnostic signs should make the dentist, who sees little except the head and hands, suspect such conditions?

THYROID

Extreme nervousness accompanied by a fine tremor of the hands (not the usual tremor from fear) and profuse perspiration are suggestive of hyperthyroidism. If exophthalmic bulging of the eyes is also present, the diagnosis can almost be assured. On the opposite end of the scale, a dry skin, coarse cracking hair, thick lips and a rather dull set of nerves suggest a hypothyroid state. Confirmatory evidence of this picture is seen in abnormally soft enamel and dentin, with excessive root resorption and sparse crown enamel. This abnormal decalcification is evidenced by x-ray study in both endemic and sporadic cretinism and runs parallel to retarded osseous development.

PARATHYROID

It is a common feeling that the above-mentioned decalcification is due for the most part to a concomitant parathyroid dysfunction which usually goes along with the hypothyroid or hyperthyroid syndrome. Other evidence of parathyroid disease may be a tendency to muscle trismus or spasm and excessive fragility of bones and teeth. All patients having cystic mandibles or areas of decalcification should be examined regarding their calcium metabolism before much extraction work is undertaken.

PITUITARY

Pituitary dysfunction causes structural change rather than a predisposition to caries. Excessive jaw growth which results in overbite, or very wide separation of the teeth, is suggestive of hyperpituitary disease. The teeth themselves are usually smaller than average, which in turn accentuates the facial features as seen in acromegaly, which is an extreme degree of this syndrome. In hypopituitary conditions, we may find the narrow jaw, high-arched palate and small crowded teeth, with a general bone brittleness, as seen in Paget's disease (osteitis deformans) and the less severe forms of deficiency.

GONADS

Gonadal deficiency also manifests itself in structural changes as well as in numerous personality peculiarities. The relationship of dental structure to the gonads is indirectly through the disturbed endocrine balance which results from ovarian or testicular dysfunction. Its importance is in recognizing and associating this relationship.

Suggestive signs of gonadal deficiency are grossly evidenced by a changed personality. Effeminate males often show smooth soft skins, with a scanty or light beard. A female distribution of fat in mild cases can be purely gonadal, but, in more marked instances, it means that the pituitary and thyroid have also suffered exhaustive changes. It is commonly described as Froelich's syndrome when genital hypoplasia is present.

A soft high-pitched voice and effeminate mannerisms are less dependable signs unless associated with some of the previously mentioned conditions.

Some years ago, it was suggested that the presence of "large pointed canines" or sharp small upper incisors (often missing) is due to hypogonadism. Continued observation has not confirmed this as far as I can determine from the literature.

PANCREAS

Hypoinsulinism, or diabetes mellitus, is the most common form of pancreatic disorder. The symptoms are: general debility, tendency to infections that fail to heal and, locally, an increased mouth sepsis, with decay. This is often accompanied by pallor, polyuria and dysuria, with a rosy pink mucous membrane and a shiny tongue in the early stages. Coated tongue in its later phases occurs with digestive disorders.

The diagnosis is easily confirmed by finding sugar in the urine or a characteristic high blood sugar. In order to obtain satisfactory results with any kind of corrective measures, it is essential to have these patients on a régime which corrects the glycosuria and high blood-sugar content. If the development of a lactic acid forming medium in the mouth is a cause of caries, we certainly cannot afford to overlook these numerous diabetic cases.

Treatment of these various forms of endocrine disorders naturally belongs to the competent medical practitioner. Little need be said here except that most forms are amenable to treatment when recognized.

METABOLISM

The importance of mineral salts, food and vitamin metabolism was recently a topic of discussion at the American Dental Association meeting, details of which are easily available. One must emphasize, however, the necessity of being on guard for iron, calcium, phosphorus, food and vitamin deficiency states even more than years ago.

Malnutrition is often masked by a general obesity or the use of deceptive cosmetics. The mucous membranes and conjunctiva can be relied on for evidence of anemia, but this should always be established by a blood count. The importance of the blood count can be seen from the report of a case with signs of vitamin "C" deficiency.

REPORT OF CASE

History.—A woman, aged 40, who was working and keeping house for herself, gave a history of exhaustion of five years' duration. Hemorrhagic spots had been present two months.

Examination.—The skin was pale and the tongue glossy, with deep fissures. Petechiae and hemorrhagic areas of the skin were evident, with areas of depigmentation.

Laboratory Tests.—The capillary fragility test showed sixty spots in seven minutes (normal, ten or under). A blood count in April 1937 showed a hypochromic anemia. The blood calcium was 10.2 mg. per hundred cubic centimeters. The blood Wassermann reaction was negative.

Treatment.—Cebione (cevitamic acid), 1 gm., was given intravenously three times a week, and 300 mg. was given by mouth daily. Orange juice, 12 ounces, and potatoes with the skins on were given daily. Ten days later, capillary fragility showed twenty spots and the patient was much better. Two weeks later, there was sudden recurrence of symptoms in spite of continued treatment. A blood count showed a typical pernicious anemia (hemoglobin, 45 per cent; red blood cells, 2,000,000; color index, 1.1). Liver by injection and by mouth was prescribed with cebione by mouth only.

Outcome.—The present blood count is: hemoglobin, 90 per cent; red cells, 4,000,000. The patient is almost symptom free as regards the mouth and tongue conditions, exhaustion and ecchymosis. The capillary fragility test shows twelve spots.

VITAMINS

Vitamin A and D deficiency usually go hand in hand. Of the signs of this condition most likely to be observed by a dentist, xerophthalmia or inflammation of

the eye with a purulent exudate is indicative of a rather advanced vitamin A deficiency. If, along with this, there are excessive gum sponginess and pyorrhea alveolaris, a vitamin A deficiency of years' standing may be suspected. Some authorities assert that vitamin A is a specific in these conditions, but more exhaustive studies are necessary to establish this as a truth.

It is important for us, in the present state of our knowledge, to realize that no deficiency state "with the possible exception of scurvy" is uncomplicated.

One of the most commonly accepted uses of vitamin A is its employment in increasing resistance to infections. Here, its value apparently rests in an ability to keep intact the skin epithelium, which in turn resists the entrance of bacteria.

A vitamin D deficiency is the best known and probably the most easily combated deficiency. Its direct effect is rickets or faulty bone growth. In a majority of cases, there is a low blood phosphorus with a slight reduction of blood calcium, the imbalance being the direct cause of the failure of ossification of growing bones. In the presence of adequate vitamin D, however, the proportion of calcium and phosphorus in the diet is immaterial, because whatever is present can be used to best advantage. This ability to cause calcification is responsible for the proper formation and development of teeth and also for the laying down of secondary dentin.

Unfortunately, vitamin D is very poorly distributed in the average diet and so an outside source is required. An easily available source is the ultraviolet rays of the sun. We also can irradiate foods by artificial means and assure some vitamin content, but the most valued source is the liver oils of deep sea fish: cod, halibut, percomorph, perch, etc.

It should be emphasized here that these oils are adequate without the process of concentration. In prophylaxis in children, the unconcentrated is much preferred to the more potent form.

Vitamin C deficiency is the cause of scurvy. Lesser degrees of this deficiency are of greater importance, however, because we rarely see advanced scurvy and often overlook the less severe forms.

Hemorrhagic conditions, sore tongue, cankers, spongy conditions of the mucous membranes and vague digestive upsets should suggest this as a cause. Later changes may also cause a diffuse form of atrophic pyorrhea.

There has been some question whether vitamin C loss alone could cause signs of

Food Sources of Vitamins

Vitamin A	Vitamin B	Vitamin C	Vitamin D
Cod liver oil	Wheat germ	Asparagus	Cod liver oil
Halibut liver oil	Yeast, brewers'	Cabbage, raw	Halibut liver oil
Butter	Beans, soy	Grapefruit juice	Egg yolk
Carrots (raw)	Bran	Lemon juice	Herring
Cereal	Bread, whole wheat	Lettuce	Salmon
Cheese	Cereal	Orange juice	Sardines
Cream	Cereal, whole wheat	Peas, green	Tuna fish
Eggs	Egg yolk	Peppers, green	
Herring	Hazelnuts	Spinach	
Ice cream	Lentils	Tangerines	
Liver, beef or pork	Peas, dried	Tomatoes, raw or canned	
Milk	Rice, unpolished	Watercress	
Roe, fish			
Salmon			
Watercress			

scurvy. Alfred Hess, a pioneer in vitamin research, is of the opinion that it is the unrestricted growth of intestinal bacteria which follows a deficiency of vitamin C that really causes the symptoms. This is certainly suggested by the different forms of vitamin C deficiency found in man and animals.

The average infant's diet is made up almost exclusively of milk and cereals, both poor in vitamin C. The major sources are fruit, especially the citrous forms, green vegetables and potatoes.

Excellent synthetic preparations of ascorbic acid are also available on the open market. A prophylactic dose of fruit juice is 16 ounces a day and a therapeutic dose, 100 mg. (0.01 gm.) of cebione.

A brief résumé of vitamin sources in foods is listed in the acompanying table.

INFECTION

Infection is present in nearly all forms of disease. Its relation to dental caries is just beginning to be considered.

Briefly summarized, the latest acceptable theory of infection and its relationship to decay processes is as follows:

Cultural studies most uniformly show mixed flora present in most carious areas or in diseased oral membranes. There has been no proof of a single or even a dual organism which is a specific cause for caries.

Certain symbiotic relationships seem to exist (1) between bacteria themselves, (2) between bacteria and their toxins, (3) between bacteria and certain foods and (4) between bacteria and the by-products of foods. The most likely relationship seems to be evidenced in the formation of certain acids, *i.e.*, lactic, from bacterial flora, which, in turn, affects the bony and mucosal tissues, making them susceptible to the ravages of other organisms. Much work is being done on this problem and we may hope for a solution in the not too distant future.

At present, the indications are that free sugars in the mouth are very favorable media for the growth of the lactic acid bacillus and its related organisms. We are not in a position to say whether this acid content is the cause of caries. The present theory is that it, in combination with the bacteria, local nutritional defects and poor general physical condition, results in what we call tissue destruction or caries.

CONCLUSION

There must be close cooperation in matters clinical and scientific if these and other problems of medicine and dentistry are to be solved. At the present time, speaking for the medical profession, I can say that we are willing and eager to cooperate in all the ways mentioned. The future of both of our professions is at stake from the inroads of incompetent clinics, government control and uninterested or uninstructed members within our ranks.

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PREPARATION OF RIDGES IN FIXED AND REMOVABLE RESTORATIONS

By Frederick F. Molt, D.D.S., Chicago, Ill.

A FIXED bridge may be adapted to a ridge that would be distinctly unfavorable for a removable bridge or a partial denture. Nevertheless, when the opportunity arises, coincidently with our extraction procedure, to prepare such an area in a desirable way, it should be done. Further loss of teeth may call for extension of restorative work and the fact that this portion has been "prepared" will obviate duplication of operative interference.

We seem, fortunately, to have outlived the age of pontics extended into fresh sockets and to have returned to adaptation to the ridge. Surgical judgment and care and a preliminary study of the case and of the restorative problem will make possible a result satisfactory for either type of restoration, fixed or removable. It may be said that the chief difference in the requirement is that for a fixed bridge, preparation is desirable for removable essentials.

Three problems arise in preparing the ridge for a restoration: (1) achieving a result that will permit of replacement in the shortest space of time, (2) providing for the natural positioning of the teeth and (3) making possible the wearing of the bridge with the maximum of comfort or, shall we say, the minimum of discomfort. The value of natural resorption, depended on entirely before the introduction of surgical methods of ridge preparation, was and still is vastly overrated. It involves a long waiting period, in the first place, during which time the occlusal balance may change perceptibly; the teeth robbed of opposition may suffer from disuse atrophy, and the intended abutment teeth may drift. Resorption, as well, cannot be in any degree altered or regulated. We take what Nature gives us as a result, unfavorable though it may be; for, more frequently than not, the portion of the alveolar process that we would like to see resorbed is not, whereas we lose some that we would like to retain.

Obviously, the extraction procedure itself is or has been a major factor in the nicety of the result. It must be granted that, in many cases, little surgical work is required inasmuch as all ridge that may be retained is needed. On the contrary, many cases demand surgical methods of preparation in order that (1) extraction may be complete, (2) laceration be avoided, (3) pathologic areas be entirely extirpated, (4) prospective abutment teeth not be disturbed or unnecessarily denuded, (5) undercuts be eliminated, (6) a rounding, comfortable base be prepared for the saddle, (7) sufficient space be provided for the necessary reconstruction and (8) healing be accelerated and comfort enhanced. Considering, therefore, that all these may be gratifyingly achieved by careful operative effort, catch-as-catch-can, wing-shot extractions seem contraindicated in a large percentage of cases. Logically, the foundation may be considered quite as important as the superstructure, and although the dentist may take pride in overcoming

(Read before the Section on Partial Denture Prosthesis at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 15, 1937.)

the handicap of an unfavorable ridge, study of the case and competent surgery may well avoid this necessity.

Taking the enumerated advantages seriatim, we may enlarge on them:

1. Complete extraction is desirable in order, first of all, that the tooth, which may have been a focus of infection, shall not be in any part retained; that there may be no subsequent disturbance from a retained root, or that, in order to remove it at a later date, subjecting the patient to an undesirable duplication of operation, the ridge may not be perceptibly altered.

2. As a result of laceration, frequently much cicatricial tissue remains on healing, with adhesions and altered muscle attachments.

3. Retained pathologic masses, besides continuing to harm the patient, frequently become cystic, if not already so, invading surrounding territory, and may, at any time, become acutely infectious. Such residual areas are, as well, foci of infection in themselves.

4. The advantage of preserving abutment teeth from denudation or loosening is obvious.

5. No mechanical appliance of unyielding material can fit satisfactorily over a prominence and into an undercut. In order to have the saddle bear uniformly, the undercuts should be done away with by reducing the prominences. This is particularly true of a bilateral restoration and one with the so-called "precision attachments."

6. A rounding ridge presents the most stable and comfortable bearing surface.

7. Uneven, asymmetrical ridges frequently make it difficult to introduce teeth of the proper shape and size or with ridge lap in the desired position.

8. The rounding of process margins and complete closure of the wound, when possible, hasten healing, avoid dry socket and make for comfort.

It must constantly be impressed on men who are doing restorative work of this type that there is a vast difference, from case to case, as to the quality of bone present. This must of necessity be reflected in the stability of the ridge and the amount and rapidity of change that may be expected in the individual case. McKevitt's classification, based upon roentgenographic study of a large number of cases, divides bone into hypocalcemic, hypercalcemic and, between these, the normal. Every dentist has experienced the embarrassment of introducing dentures or partial restorations into a mouth and having the supporting structures seem veritably to melt away from beneath them. If, by study of the roentgenographic findings, this result may be anticipated, and not only the patient be warned as to that prospect but also a type of restoration introduced that will permit of frequent rebasing, both patient and operator will benefit. Both the hypocalcified and the normal bone will resorb. The hypercalcified, which is less frequently encountered, shows little resorption over a period of time.

When resorption is excessive, the restored teeth cease to function, particularly in those cases having no posterior abutments, a break down and eventual loss of additional teeth resulting. Many beautifully made gold-saddle cases begin almost immediately to act as orthodontic rather than restorative appliances. A rebasable type, therefore, should be chosen for hypocalcified ridges and the case carefully watched.

In this preliminary study of the bone structure, the comparative radiopacity is the determining factor. The honeycomb of the reticulum is discernible in the normally calcified bone and almost completely absent in that of extreme hypocalcification; whereas, in the extensively hypercalcified, the osseous structure may appear almost structureless and practically as radiopaque as tooth structure itself. What may be the causative factors in bringing about such a variance, we do not know. Biologic chemists have added

to our knowledge of calcium and phosphorus metabolism. Perhaps, in time, we may be able to build up the hypocalcified case to at least normal calcification, but, at the present, fortifying the diet with calcium and phosphate is apparently without result.

We have dwelt on the preparation of the case presented for extraction by the elimination of undercuts and sharp process margins and by rounding the ridge. Every effort is made, of course, to preserve all the interdental septa and to shape them symmetrically. They then act as a support for the mucoperiosteum and as a matrix for regenerating bone.

Many conditions are met with that, though unrelated to the extraction problem, require attention in order to simplify the restorative work, even to make a satisfactory restoration possible. Excessive bony excrescences in the palate (torus palatinus) hamper the fitting and the wearing of palatine-bar partial dentures quite as much as of full dentures. Such a condition is cared for by incising at the median line from the posterior to the anterior border of the prominence, then diagonally toward each cuspid. The tissue is freed and retracted with great care because, being quite thin, it will tear readily. To avoid bruising the tissue, each flap may be sutured temporarily to the lateral mucosa. With chisel and mallet, the bone is reduced, a shaving at a time, to the desired level. In very large growths, it is advantageous to honeycomb the mass with a surgical drill to expedite the reduction. The flap is replaced and any superfluity trimmed away. Sutures should be of a type that will not absorb as they should be retained for a week or ten days. Healing in the palate progresses more slowly than in most other mouth wounds, probably because of the thinness of the tissue and consequent limited vascularity.

Bony excrescences of similar structure, sometimes called osteophytes, are found in many mouths upon the lingual surface of the mandible and the buccal surface of the maxilla. The removal of these is accomplished in an identical manner: A small semilunar incision is made immediately above a mandibular growth or below the maxillary prominence, if on a healed ridge, and the flap retracted. Of course, if the area is being prepared by extraction and process reduction, the flap already open is retracted as far as necessary. A chisel with flat side toward the process is directed toward the mass and a single mallet blow will usually remove it quite readily. It is frequently necessary to remove such a prominent mass in a dentulous anterior to provide for a comfortable lingual bar to the edentulous posterior areas. A very essential precaution in removing these lingual mandibular growths is to hold a straight end periosteotome immediately below the mass to avoid losing it under the periosteum. With the instrument holding it, the detached fragment can be lifted out with tissue or hemostatic forceps.

A combination of atrophy and hypertrophy is found in many cases in which edentulous areas have had improperly fitted prosthetic appliances or absorption has been excessive and the appliance is still worn. In this condition, the presence of an excess of soft tissue prevents accurate impression taking or the wearing of any denture in comfort. The atrophic destruction of the ridge eventuates in a sharp knife-edge upon the crest, which aggravates the hypertrophy and makes the pressure of the denture very painful. In these cases, an incision is made on either side of the crest of the ridge and the hypertrophied tissue, which is lifted away in a strip. With the knife-edge ridge disclosed, smoothing is accomplished with mallet and chisel. No more than one or two sutures, frequently none at all, are inserted.

In cases in which there has been extensive pyorrhea before extraction or saddles (or dentures) have been worn for a long period, the mylohyoid ridge may be so prominent and so sharp that any pres-

sure against the bony ridge is agonizing. In these cases, an incision is made on the crest of the ridge, the lingual mucoperiosteum retracted, as in the removal of the osteophyte, and the necessary reduction made to smoothness. In this procedure as well, in order that the bone being removed may not be "lost" among the muscle fibers, it is necessary to hold the retractor below it. No doubt, removing this bone detaches at their insertions some of the muscles involved, but observation of a large number of cases has shown no deleterious effect; on the contrary, a uniformly comfortable result. Not only is comfort achieved, but also it is possible, after this reduction, to carry the saddle or denture well down on the lingual aspect—a distinct advantage in stabilizing the denture.

In cases in which full or partial dentures have been worn over a long period of time, there frequently appear sharp and prominent spines or bumps upon which the denture or saddle is worn with discomfort. This condition is due to eburnation in the alveolar bone, usually in the mandible, and, with the difference in the osseous structure, as the adjacent bone is absorbed, these sclerotic, ivory-like "islands" come into prominence. If, by "relieving" the saddle, comfort cannot be obtained, it is perfectly feasible to open the tissue with a semilunar incision and chisel away the prominence. No assurance can be given, however, that the situation will not recur after a period of time, and reoperation be required.

Flabby tissue in the tuberosity area is usually removed by taking out a wedge-shaped portion. If the tissue is exceedingly thick, it may be desirable to remove a small wedge laterally and medially before suturing. Any undercuts may be reduced at the same time.

Frenum attachments that extend to the crest of an edentulous ridge or muscle attachments that do likewise and that interfere with the seating of denture or saddle can all be satisfactorily altered. In the case of the frenum, a diagonal incision is extended upon each side, the attachment loosened and the tissue carried outward and snipped. A cross suture brings the tissue into apposition. Muscle attachments are simply snipped and incised down to the periosteum. This leaves a diamond-shaped opening, which is closed with a cross suture. Many of these troublesome muscle attachments are attributable to careless extraction with much laceration and the subsequent forming of cicatricial tissue.

Surgery of the mouth is so logical and the structures respond, usually, so favorably that it seems quite unnecessary to go through many of the intricacies in construction formerly considered unavoidable. One undertaking this work, however, should be prepared to adhere closely to a régime of surgical asepsis. It can be done and no lack of effort toward that end is pardonable. A recently developed mercurial preparation—entirely harmless—will render the mouth bacteria free and keep it so for a matter of two or three hours. The rules of surgical asepsis are too well known—or should be—to require repetition.

The routine of so-called surgical removal has been described from time to time over a period of years. "Open-view" operative procedure is the most descriptive term applied to this, for it is just that. Instead of digging blindly or curetting by sense of touch, one is enabled to *see* the sequence of operation. With the immediate closure of the wounds, healing is expedited. With the underlying structures smoothed and rounded to the desired shape, the healed result is a comfortable base. Inasmuch as this can all be accomplished incidentally to the extraction, it seems a logical service to render at that time.

25 East Washington Street.

TREATMENT OF NON-UNION AND LOSS OF SUBSTANCE IN FRACTURE OF AN EDENTULOUS MANDIBLE

By Paul I. Addison, D.D.S., Albany, N. Y.

THE management of fractures of edentulous jaws has long been a besetting, troublesome problem to the oral surgeon. It may be likened, in effect, to attempting to bind two rubber balls by tying them around with a string. If the reduction and maintenance of a fractured jaw with a full or partial complement of teeth is unique in respect to general fracture therapy, the uniqueness of the fractured edentulous jaw is doubly apparent. Nevertheless, the treatment of these cases has resolved itself into two, possibly three, simple and effective procedures.

TREATMENT

Procedure 1. This, not necessarily the most efficacious, is simply the insertion of the patient's dentures or a compound or vulcanite bite-block in place of lost or broken dentures and tightly bringing the mandible into occlusion with the maxillae by a firm chin-strap attached to some sort of headgear. This has been brought out by Mead,[1] who illustrates a plaster headgear of the Scogin type with a rubber dam chin-strap. Aufderheide[2] has illustrated a similar arrangement. I have had excellent results in several cases with a plaster Scogin headgear and a plaster chin-strap formed of plaster bandage over stockinet placed under the *symphysis menti* and directly incorporated in the freshly plastered head cap.

Procedure 2. Many such fractures, especially those near the midline, with little displacement and equalized muscle pull, have been seen to heal uneventfully with the application of a modified Gibson bandage and a word of caution to the patient. Exact appositioning of the fragments is not essential in edentulous fractures, as prosthetic correction can be later effected. However, this should be a procedure of necessity, not of choice.

Procedure 3. This procedure, first suggested by G. V. Black and later practiced by Ivy and Curtis,[3] is circumferential wiring. By this method, as these authors have so ably illustrated, a vulcanite or metal saddle is constructed to fit over the fractured area with the fragments in correct position. The saddle is firmly splinted by making external incisions on each side of the fracture line, passing an antrum trocar close to the bone and into the vestibule of the mouth to one side of the saddle and passing through 24-gage brass wire, and following the same procedure lingually, tying the wire tightly over the saddle and closing the external incision. Schaefer[4] has illustrated a modification of the same method, exposing the whole fracture area externally and placing both wires through one larger incision. It is my conviction that the safest course is to stay clear of the traumatized area and pass the wires through two separate incisions as far away from the line of fracture as is consistent with good fixation.

Circumferential wiring is indicated where there has been considerable displacement or where the fracture is in the

premolar or molar area with a strong tendency to serious displacement and compounding by increased, unopposed muscle tension. The principle in the treatment of the following case essentially follows that popularized by Ivy and Curtis. A Labat spinal trocar and cannula was used in preference to the heavier antrum trocar and was found to be very effective in reducing trauma. Twenty-eight-gage Krupp stainless steel wire was employed in lieu of 24-gage brass and proved much cleaner and stronger, less inclined to stretch and break and subject to frequent tightening with impunity.

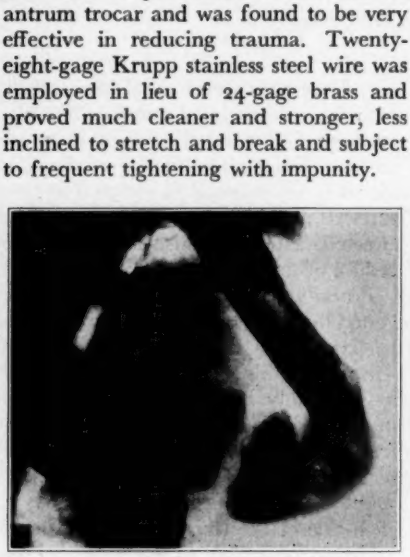

Fig. 1.—Roentgenographic appearance January 10, 1937, five months after injury.

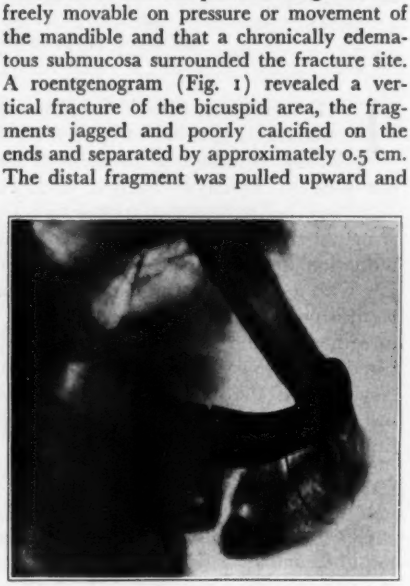

Fig. 2.—Postoperative roentgenogram, taken January 19, 1937.

REPORT OF CASE

The patient, a man, aged 65, was struck on the jaw in a brawl during August 1936. He sustained a fracture through the right bicuspid area and was taken by his physician to his dentist, who immediately wired the four remaining teeth, all cuspids, together. There was unopposed, upward muscle tension on the posterior fragment, however, and the patient developed osteomyelitis. A large sequestrum was removed through an external incision which had been made for drainage under the bicuspid area of the mandible. Drainage ceased in the middle of October 1936, and the external wound healed, leaving a deeply retracted, stellate scar, the tissue firmly adherent to the bone. From that time until I saw the patient, January 10, 1937, there were no further complications.

January 10, 1937, the patient was sent to my office for consultation. He complained of complete anesthesia on the right side of the chin and lip area, and lancinating pain in the posterior portion of his jaw and the overlying mucosa when walking or talking. Examination showed that the posterior fragment was freely movable on pressure or movement of the mandible and that a chronically edematous submucosa surrounded the fracture site. A roentgenogram (Fig. 1) revealed a vertical fracture of the bicuspid area, the fragments jagged and poorly calcified on the ends and separated by approximately 0.5 cm. The distal fragment was pulled upward and inward out of alinement, pressing tightly against the mucosa. A plaster impression was taken of the ridge and a cast was poured, sawed in half through the fracture line and correctly alined. This corrected model was used for the construction of a notched vulcanite saddle made to include the incisor and third molar areas. The patient was observed for nine days to make certain that there was no residual infection in the area and to effect routine preoperative examination of the blood, which was found to be normal with the exception of a slightly increased sedimentation time.

January 19, 1937, under open-cone ether anesthesia, the fracture area was opened externally with a 2-inch horizontal incision under the lower border of the mandible,

through the old scar. Cicatricial tissue was abundant and firmly adherent to the bone. This tissue and the granulated tissue between the bone fragments were removed with scissors and a small rongeur and the decalcified bone ends freshened with a coarse bone file. A hole was drilled through each fragment far enough from the roughened end to allow for absorption under tension and the fragments were drawn tightly together with twenty-day No. 3 chromic gut. (Fig. 2.) The oral mucosa was not perforated.

The deep tissues were then sutured with No. 1 chromic gut and the skin incision closed with a dermal suture. Incisions to the bone were next made directly under the midline of the chin and just in front of the angle of the mandible, safely back of the facial notch and artery. Through these incisions

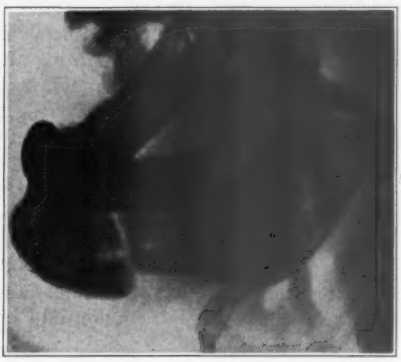

Fig. 3.—Roentgenographic appearance just prior to removal of splint. There is pressure resorption around the hole drilled in the proximal fragment.

was passed the stainless steel wire in the Labat trocar. The vulcanite saddle was placed in position on the ridge and the wires tightly twisted over the notches. By this procedure, the wires were placed as far away from the fracture site as was felt to be consistent with firm fixation. As they communicated with the oral cavity, approximation with the initial operative area might have invited reinfection of the wound and a complete nullification of all efforts to reunite the bone.

With the exception of a mild postoperative edema, there were no further complications, and the incision under the fracture area healed within two weeks. The wires were well tolerated by the tissues and were tightened frequently. There was very slight suppuration from the chin and angle incisions, but no discomfort. January 30, 1937, the patient was discharged from the hospital. After his discharge, at no time did the white blood count rise above 8,600 nor the sedimentation time above seventeen minutes. The blood calcium and phosphorus dropped from 10.1 and 3.8, respectively, per hundred centimeters, February 2, to 9.0 and 2.6, respectively, February 18, despite massive doses of dicalcium phosphate and three capsules of viosterol in halibut oil per day. On the advice of R. H. Ivy (written communication), the splint was left *in situ* until March 3, 1937. On removal of the splint, six weeks postoperatively, the bone fragments were

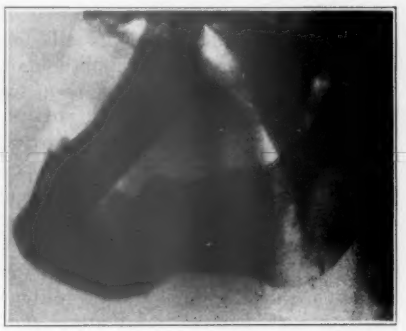

Fig. 4.—Complete bony union, January 30, 1938. A smoothing off of the jagged processes is evident.

found to be firmly fixed and only slightly movable when pressed inward. The patient was able to walk, talk and swallow with perfect comfort.

Figure 3 shows the approximation just prior to removal of the splint. The age of the patient precluded rapid ossification even if ossification could be ultimately effected at all, and he was discharged with cautions as to his diet and the use of his jaw.

January 30, 1938 (one year later), palpation and roentgenographic examination (Fig. 4) disclosed a firm bony union. There is present a partial anesthesia of the lip and chin, which is progressively improving. The

man is healthy and is employed, and he is able to wear dentures.

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249 State Street.

EFFICIENCY IN CAVITY PREPARATION

By R. W. Rule, D.D.S., San Francisco, Calif.

OPERATIVE dentistry constitutes a major portion of the work of dentists in general practice. The work is exacting. We must see many patients and the time for each is necessarily limited, yet we cannot accomplish more than can be done with our own two hands. To those of us who regard our work as an art in which we are anxious to excel, there is the ever-present problem: How are we to do this work in such a way as to obtain the results we are striving for in a minimum of time and with a minimum of discomfort to the patient? Our economic and professional status is such that we must attain these results that we consider excellent in a period of time and in such a manner as will be acceptable to the patient and practicable to ourselves. It is my hope in this presentation to contribute toward the solution of this problem.

In the procedures of operative dentistry, we must, if we consider excellency of attainment a part of success, follow the technical steps with care and precision. Technical proficiency is attained not alone by giving careful attention to detail, but also by planning and systematizing each given piece of work, by planning our work, shall we say, and then working our plan!

In any field of technical procedure, speed may be attained by slighting the work. This is never commendable and least of all in a profession rendering a health service. Therefore, it is not my purpose to present a high pressure system by which more dollars may be earned in a given length of time, but to help the average operator to see where in his work he is losing time by a failure to systematize various procedures and take up the slack of lost motion and indecision.

The procedures of operative dentistry are highly technical, and although each case may present its own individualities, it is surprising how closely the large majority of them conform to a systematized instrumentation and how easy it is to foresee and carry out the changes which may be necessary in any individual case. But because of the technical nature of the procedures, it must be recognized that efficiency here depends, as in other fields, on systematizing the work. In the case of the individual operator, doubtless much depends on the early training or perhaps the lack of early training along these lines. Still, the man who is concerned about his inability to accomplish

Read before the Section on Operative and Preventive Dentistry at the Seventy-Fourth Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1938.

good work rapidly need not be discouraged, for well-directed study and persevering effort will work wonders.

INSTRUMENTATION

The secret of efficiency is to have a definitely planned system and then to follow it as closely and effectively as possible; divide a given piece of work into its component elements; fit an instrument and method of procedure to each part, and then, in proceeding with the work, see that each step is completed before the next is undertaken.

In general, an entire filling operation is to be divided into:

1. Early consideration and planning of the treatment.

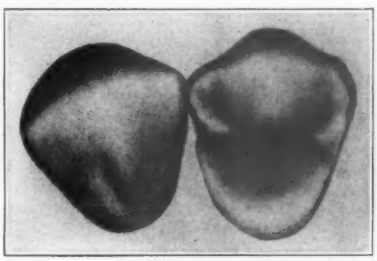

Fig. 1.—Initial cavity.

2. Adjustment of the rubber dam.
3. Cavity preparation.
4. Filling procedures.
5. Finishing of the restoration.

Let us consider in some detail a Class II gold foil restoration. I shall refer later to the differences for amalgam and inlay restorations.

The patient is seated in the chair. The mouth has been examined and the cavity located, let us say, on the mesial surface of an upper left first bicuspid. (Fig. 1.) We consider the general condition of the patient's mouth as to susceptibility, the relationship and alinement of the teeth, the condition of the septal tissues, etc. Now we study the occlusion, estimating the probable amount of stress to be borne and visualize the surface outline of the cavity with reference to strength of the restoration, access and extension for immunity. We then adjust the rubber dam.

We shall divide this cavity preparation into ten steps, one of which, Step 6, is to be eliminated in a large number of cases, where it is unnecessary. Each step requires one bur or one instrument or perhaps a pair of right and left. The instruments will be enumerated with the steps as we come to them. The plan is to complete each step with its particular instrument or pair of instruments and then lay them aside, not to be used again. Herein lies our whole secret of success, and the plan must be followed studiously until it becomes a habit. It not only forces one to be sure of his ground as he proceeds so as not to have to return to any given step, but also definitely speeds up the work and, with practice, results in much finer workmanship.

The instruments are laid out in order with cutting edges pointing toward the operator's hand, No. 1 nearest to him and the others in proper sequence. The assistant can be trained to do this if it is desired.

Step 1. It is necessary to consider two plans for opening or gaining access to the cavity. The plan of choice, whenever it is possible, is given first and is as follows: A thin, sharp 10 width Wedelstaedt chisel is grasped with a firm finger or thumb rest for control, and the enamel is broken down at the edge of the cavity (Fig. 2), following around from buccal to lingual surface or vice versa. Hand power is preferred for this step, but the pneumatic mallet may be used in conjunction with specially made chisels. In any case, the chisel must be thin and sharp and carefully controlled. It is surprising how large a proportion of cavities may be opened in this way, and the procedure is by far the quickest as well as the easiest on the patient, the operator and the equipment.

If the first plan is deemed inapplicable, the second plan must be followed: The weakest spot along the groove is selected, usually at the mesial pit, and entered to the dentino-enamel junction with a small round dentate bur or an inverted cone bur, or, if preferred, a bibeveled drill. If caries has started in the pit or groove, entrance may be made on the occlusal surface with a chisel in preference to or in conjunction with entrance on the proximal surface. The main objective of the first step is to gain sufficient access to the cavity to reach the dentino-enamel junction with an inverted cone bur and, in the larger cavities, to undermining and weakening the distal marginal ridge and distal wall and, in principle, applies to all occlusal surface cavities wherein the end of the groove cut approaches a marginal ridge closely enough to weaken the ridge if cut to a right angle with the pulpal wall. The end of the bur should now be run lightly across the pulpal wall to even it up and to take a little from either or each of the side walls to allow for the proper width of the step portion of the cavity.

Step 3. With a 15 width Wedelstaedt chisel, the buccal and lingual walls of the step portion are straightened up (Fig. 4), extended to the proper width and

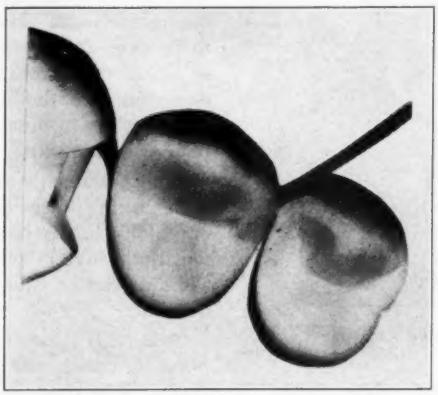

Fig. 2.—Thin small chisel in position for opening cavity.

clear away as much of the undermined enamel as is practicable at this stage.

Step 2. With a No. 34 or No. 35 inverted cone bur, the operator cuts through at the dentino-enamel junction under the marginal ridge, if it is still present. (Fig. 3.) The grooves are followed as far as is necessary, the operator keeping in mind the outline form and the necessity for stopping in an area where a smooth margin can be made. As the bur approaches the distal marginal ridge, the handpiece is inclined distally to slope the distal wall to a slightly obtuse angle with the pulpal wall. This is to avoid widened out toward the proximal portion, to give better access for the next step.

Step 4. A No. 35 inverted cone bur, with about half its width cutting in the enamel from the inner surface and half in the dentin, is swung back and forth buccolingually, cutting gingivally to the desired amount of extension for the gingival wall and angles. (Fig. 5.) It is important to carry this step to satisfactory completion at this time so that it, with the succeeding steps dependent on it, will not have to be repeated later. A little care in each case soon develops the

judgment on this point. The bur is now run lightly across the gingival wall to even it up and is drawn occlusally along the linguo-axial and bucco-axial line angles if any further extension is needed there. This completes the work to be done with burs.

Step 5. A 15 width Wedelstaedt chisel is now used to complete the outline form and to square the buccal, lingual and axial walls, in working toward a box form. (Fig. 6.) It may be well to note here that the buccal and lingual walls of the proximal portion of the finished cavity each lie in three distinct planes, the dentin portion being approximately in the mesiodistal plane, and this part of the buccal and lingual walls being parallel or very slightly undercut mesiodistally, providing the retentive box form. (Fig. 7.) The enamel walls should flare buccally or lingually in the direction of the enamel rods (Fig. 8) and the cavosurface bevel should incline about three centigrades outward from the plane of the enamel walls. The enamel walls are formed in this step and such part of the box form as may be made with the same instrument. The cavosurface bevel is left until later.

Step 6. We have alluded to the fact that Step 6 is often not needed. Should any carious dentin remain, it is now removed with a pair of spoon excavators, 10-6-12 or 15-8-12, and a cement base made if indicated. It will often be apparent before the cavity is opened whether this step will be needed or not and the spoons laid out accordingly. In large and deep cavities, it is often well to remove all the carious dentin as soon as the cavity has been completely opened, and thus determine at once its status regarding pulp involvement. If a cement base is needed, it should be placed before the box form is made so that the latter may be at the proper depth with relation to the axial wall and the pulpal horns. With a keenly sharp spoon excavator, caries can be removed rapidly, and when the decalcified dentin is gone, a smooth, hard, almost glistening surface will remain. In many instances, it is well to moisten the cavity with eugenol while removing carious dentin. This tends to lessen pain if the cavity is sensitive and

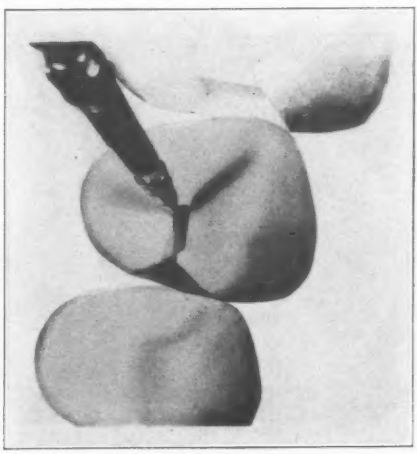

Fig. 3.—Inverted cone bur following central groove after cutting through marginal ridge.

also softens the partially decalcified dentin, making it easier to distinguish between this and the sound dentin.

Step 7. The long hoe, 12-8-12, is the instrument selected to complete the box form. (Fig. 9.) The pulpal and gingival walls are smoothed and all line and point angles sharpened. A smaller hoe may be used in shallow cavities, but the width of the 12-8-12 is about the minimal width of the gingival wall for a Class II cavity, and this instrument is very effective for the purpose indicated. With a palm grasp and thumb rest control, it is particularly good for making the buccal wall and the buccogingivo-axial angle. The linguogingivo-axial angle should have been taken care of with the chisel in Step 5, or the hoe may be supplemented now with a contrabeveled Wedelstaedt chisel if necessary.

Step 8. The gingival cavosurface bevel is made with a pair of gingival marginal trimmers. (Fig. 10.) The width of choice is 0.12 mm. The 10 width is too narrow for routine work and the 15 width too wide for many cases, whereas the 20 width is much too wide. I find that the 12 width will take care of practically all bicuspid and molar proximal surface cavities.

Step 9. A 20 width Wedelstaedt chisel with keenly sharp edge is now used for planing the cavity walls and making the cavosurface bevel. (Fig. 11.) The marginal planing is best done as nearly as can be in the length of the margins, and the wide chisel is chosen, as there is less danger of its slipping off.

This work should be done with a light planing stroke, shaving the walls and margins gently until they are as smooth and even as it is possible to get them.

Step 10. In this step, the final cleansing is done. Cavity walls and margins are in the best condition to receive the filling material when they have been freshly planed as in Step 9 and then cleansed only by a blast of air followed by sweeping with dry cotton and removing the loosened particles with a few more blasts of air from the syringe. Fine particles that stick in any of the angles may be loosened with an explorer point. The cavity walls should be protected from saliva at all stages if possible. If a medicament or varnish has been used, the peripheral walls should be freshly planed. If a cement base has been placed, the walls should be examined carefully for removal of any cement that closely approaches the margins. These condi-

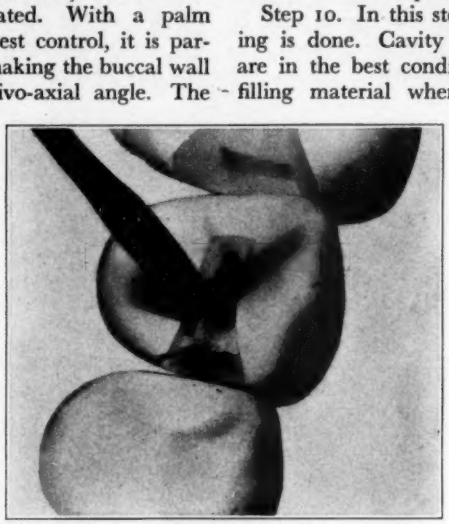

Fig. 4.—Wedelstaedt chisel, 15 width, forming buccal and lingual walls of step portion.

tions may be carried out successfully in nearly all cases except cavities for inlays. In these, every effort should be made to protect the cavity walls properly during the interval between sittings. At the sitting for placing of the inlay, the temporary filling is removed; the cavity is washed with warm water and wiped with dry cotton, and then cotton and chloroform are used to free the walls thoroughly of adherent particles of gutta-percha or varnish that may have been used. When ready for cementing the inlay, the cavity is dried and the walls again swabbed with cotton and chloroform before the final drying.

The instrumentation for distal surface

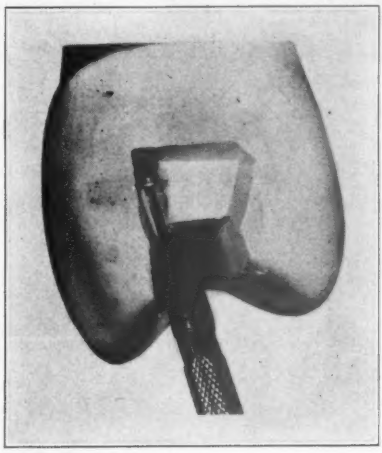

Fig. 5.—Inverted cone bur extending gingival wall and angles.

cavities of the upper teeth will sometimes call for the use of the contra-angle instead of the straight handpiece, and a pair of enamel hatchets instead of the chisels, whereas this change will be universally necessary in working on the lower teeth.

The cavity is now ready for filling. (Fig. 12.) A brief reference to the amalgam and inlay restorations may be in place here. The instrumentation and procedure for the amalgam cavity is precisely the same as for gold foil, and the form of the cavity differs only in three points; *i.e.*, the cavity is slightly broader or deeper in that part of the occlusal portion which requires greater bulk of filling material for strength; the retention form is somewhat accentuated by slight undercuts in certain places instead of having almost parallel walls as for gold, and the cavosurface bevel must be made in such a way as to leave no thin edges of amalgam which would be subject to breakage.

INLAY TECHNIC

For the inlay cavity, the instrumenta-

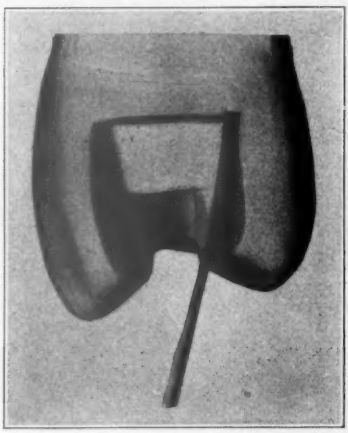

Fig. 6.—Wedelstaedt chisel completing outline form and helping to establish box form.

tion is similar, but has some specific differences.

Step 1. The opening of the cavity is the same. A small knife-edge stone may be used for cutting into the occlusal enamel where this would be an advantage.

Step 2. The following out of grooves on the occlusal surface is the same, though, since many inlay cavities are larger, it may be desirable to use a bur one or two sizes larger.

Step 3. The extending of the walls of the occlusal portion is the same as to instrumentation except that many operators prefer to use straight chisels in inlay work instead of the Wedelstaedt chisels.

Step 4. This may be carried out in the same way, although some prefer to use a 557 fissure bur for this step.

Step 5. A straight chisel, 15 width, is used to establish the approximal surface outline.

Step 6. A 557 or 558 fissure bur is used to establish occlusal dovetail and divergence of walls and to do such work on the walls of the approximal portion as may be done with a fissure bur. An end-cutting bur may be used at the gingival wall if desired.

Step 7. With a 15 width straight chisel, all cavity walls are planed. Stiff paper disks, preferably triple O garnet, may often be used to advantage to smooth such portions of the buccal and lingual walls as can be reached.

Step 8. A set of four gingival margin trimmers are used to make a gingivo-axial resistance angle and the gingival cavosurface bevel.

Step 9. The cavity is cleansed with chip blower, cotton pliers and cotton prior to making the pattern and again as indicated above for the final cleansing before setting the inlay.

In cavities where decay is extensive, right and left spoon excavators are used at the proper stage for its complete removal.

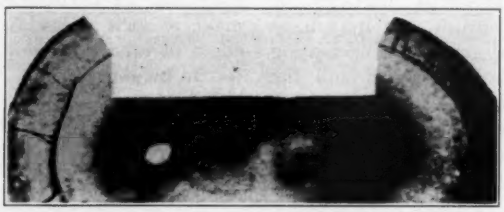

Fig. 7.—Transverse section showing box form with parallel walls mesiodistally.

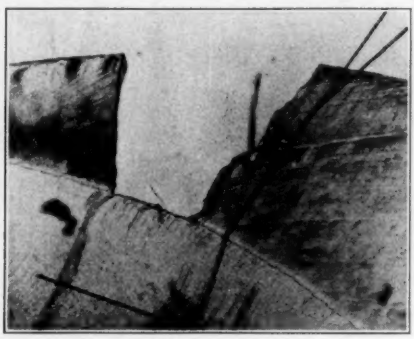

Fig. 8.—Plane of enamel wall in direction of enamel rods and relation of cavosurface bevel to enamel wall as shown by lines.

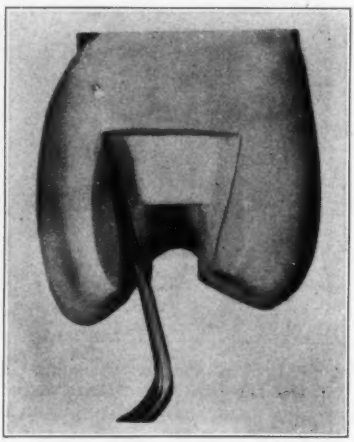

Fig. 9.—Long hoe (12-8-12) used to flatten and smooth gingival wall and complete box form.

It has been suggested that a paper on efficiency in cavity preparation calls for at least a brief discussion of controlling pain; *i.e.*, preparing cavities with a minimum of pain without the use of procaine or nitrous oxide analgesia. Certainly there is danger in the too indiscriminate use of these agents and it is quite possible to carry out the cavity preparations in a manner satisfactory to the patients without their use save in a small percentage of cases.

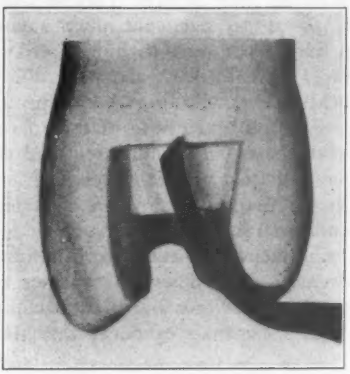

Fig. 10.—Gingival margin trimmer used to make gingival cavosurface bevel.

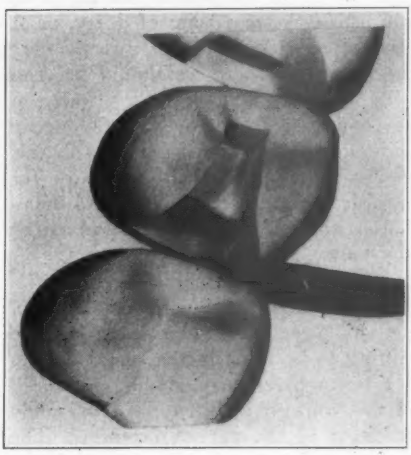

Fig. 11.—Wedelstaedt chisel used for planing cavity walls and making cavosurface bevel.

Occasionally, a patient demands the use of procaine, but, in my experience, there have been many more who have asked me to work without it. Local anesthesia, and occasionally analgesia, should be employed, but not indiscriminately. Certainly it is possible to learn to so control the patients and the pain as to make anesthesia both unnecessary and undesirable in a large percentage of cases. We cannot do more than mention here a few of the items to be considered in this connection.

First of all, it is essential that the operator establish himself in the confidence of the patient. His inability to do this will surely mean failure in the matter being considered. He must be tactful in his approach to the subject of pain, and indeed in all his conduct. His attitude, speech and actions should be positive rather than negative, yet he must avoid any appearance of being overbearing. On the contrary, he should be sympathetic and gentle, combining this attitude with firmness.

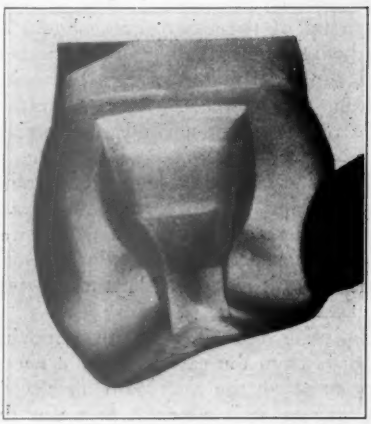

Fig. 12.—Finished cavity preparation.

A proper rubber dam adjustment affords a clean dry field to work in and

materially aids in lessening pain and discomfort, besides permitting the work to be carried on much more effectively and rapidly.

Using only sharp burs of not too large size and limiting their use to parts where they are needed for effective work is an aid. Whenever possible in cutting through the enamel, small, true-running, preferably knife-edge stones are used. In cutting dentin with burs, rapid revolutions with rather light touches, and not continued long enough to develop too much heat, will aid in avoiding or reducing the pain.

Hand cutting instruments should be used largely, but they should be very sharp all of the time. They should be used with firmness and precision and perfect control, the end of a stroke being broken by the force of the control, rather than allowed to end abruptly and forcibly against a sensitive inner cavity wall.

The operator must know tooth morphology and histology and must warn the patient when approaching an area which is expected to be painful, when the cutting is made as "short and sweet" as possible.

In using the air blast for removing cuttings from the cavity, it is not necessary to warm the air. With an electric air syringe, it is all right to warm the air provided the temperature is regulated properly, but with the hand chip-blower, the air cannot be kept at an even temperature. The thing of importance is not to use a long forced blast. This is almost sure to cause pain in a sensitive tooth. A short quick blast, rather sweeping the nozzle of the syringe past or across the cavity, is quite as effective in a dry cavity and seldom causes any pain.

Certain drugs and combinations of drugs are more or less effective in obtunding the sensitiveness, but I merely give this passing mention. One item worth mentioning is this: Frequently, with a deep cavity, the tooth will ache while it is drying out during the preparation. In all deep cavities, all of the decay should be removed as early in the preparation and as expeditiously as possible and the area over the pulp immediately be touched with a little varnish made from about 10 per cent pure French rosin and 2 per cent thymol in chloroform. This will check the pain due to desiccation and will also act as a protection to the pulp. In most of these cases, a cement base will be indicated, and this is the time to place it, afterward proceeding with the preparation as though it had been a shallower cavity.

The sequence of procedure in removal of decay is as follows: If carious exposure is feared, we begin by scooping out the larger mass of decay and then, with very sharp spoons, work boldly around the peripheral portion, where there is no danger of involving the pulp, right down to the sound dentin. This will usually leave a layer of decay, or at least of decalcified dentin directly over the pulp; and here we should proceed with great care, though not too slowly, in the endeavor to remove all the decay without uncovering the pulp. With this method, the cavity will be ready for varnish and a cement base before desiccation has had time to cause much or any pain.

As a matter of fact, these deep cavities can often be prepared with less pain than the shallower ones where there is more cutting to be done in the sound dentin.

From a psychologic standpoint, in all of this work, it is well to be moderately solicitous of the patient's comfort. The majority of patients will respond well to kindly treatment.

I sometimes tell my students that they must learn to make their patients feel that they have their welfare at heart, and the way to do this is to *have* their welfare at heart.

LIKENESS OF DENTAL ARCHES OF TWINS AND OF PERSONS WITHOUT BLOOD RELATIONSHIP

By Milton L. Braun, D.D.S., Chicago, Ill.

THE literature pertaining to the dentition of twins is very scarce. Among the most notable contributions in the field are those of Korkhaus and Curtis, Bachrach and Young, and Goldberg. Although these investigators studied the likeness in dentition between twins and their co-twins, no one has attempted to compare the extent of the likeness with that of the dentition of two persons not related to each other, nor has any work been done on the areal or dimensional difference between the arches of twins.

PURPOSE

The purpose of this paper is to compare, in various respects, the dentition of twins with that of two persons picked at random, with the idea of analyzing the probable hereditary factors. The pairs picked at random, who have no common inheritance, have been used as controls. A further purpose is to compare the dentition of sets of twins of the same class, and to compare fraternal twins with identical twins, with regard to the factors studied.

A comparison was made of the dental arches of identical twins and fraternal twins; of identical twins and pairs picked at random, and of fraternal twins and pairs picked at random. Comparisons were made of the area of the arches of one twin with that of the other, and the percentage of difference was computed, so that pairs of twins could be compared. The same was done for the dimensional size of the arches and for their similarity of shape.

(Read before the Chicago Section of the International Dental Research Society, November 15, 1937.)

MATERIALS AND METHODS

The subjects of this study were twins attending the Chicago public schools, whose names and addresses were furnished through the courtesy of the board of education. They were not chosen on any selective basis.

A personal call was made on each of fifty pairs of twins. A case history was taken, and the height and weight of the twins were recorded. Impressions were taken in black elastic compound of both jaws of each twin. These impressions were poured in plaster and the casts articulated. As it was necessary to make measurements from the first permanent molar, casts in which this tooth was missing were discarded, except in the case of one 3-year-old pair of fraternal twins, whose second deciduous molars were used. For purposes of identification, one twin of each pair was designated A, and the other, B. Casts of thirty pairs were retained.

For comparison, a third group of subjects, without blood relationship, was desired. To form such a group, selections were made from the twins, and these were rearranged to constitute unrelated pairs. The B twins were all discarded, leaving thirty subjects without blood relationship to each other. These were arranged according to the dimension between the central pits of the first permanent molars. They were then grouped into pairs, Twins

1 and 2 constituting a pair; 3 and 4, another, and so on. This method was used to eliminate, in large measure, the factor of extreme difference in size, as influencing the likeness between unrelated persons arbitrarily paired. Thus arranged, the random pairs were found to have less difference in the size of the base line, in thirteen of the fifteen cases, than had the majority of the pairs of twins. These pairs, hereafter referred to as random pairs, are, in reality, more accurately defined as pairs of unrelated individuals with nearly identical molar-to-molar diameters. Likeness in such pairs should be greater than in pairs chosen purely at random.

Fig. 1.

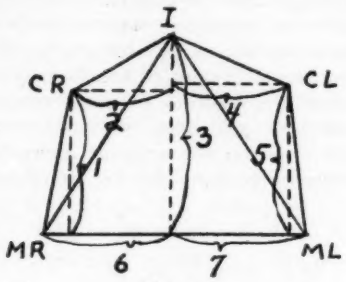

Fig. 2.

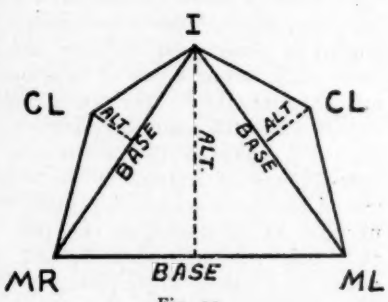

Fig. 1a.

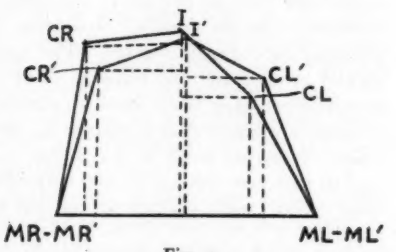

Fig. 3.

Figs. 1, 1a, 2, 3.—Five important landmarks of the arch, indicating size, shape and dimensions of the arch.

Only the maxillary arches were used in this study. The method employed in transferring the measurements from the cast of each twin to graph paper of 1 mm. measurement is described in the following paragraphs.

First, the distance from the central pit of the first molar on one side to the central pit of the first molar on the opposite side was taken by dividers, and laid out on graph paper. Secondly, measurements were taken from the central pit of the first molar to the proximal surfaces of the central incisors on each side, and laid out to form a triangle, with the molar measurement as the base. Arcs were struck from the molar point on each side with a radius equal to the distance from the central pit of the molar to the tip of the cuspid on the corresponding side, and from the incisor point, with a radius equal to the distance from the tip of the cuspid on that side to the tip of the proximal surfaces of the incisor. Lines were drawn on each side from the intersection of these arcs to the molar point and to the

incisor point, and a pentagon was produced, the sides being molar-to-molar, molar-to-cuspid, cuspid-to-central incisor, central incisor-to-cuspid and cuspid-to-molar. (Fig. 1.)

Figure 1, although indicating only five important landmarks of the arch, was accepted as indicative of the size, shape and dimensions of the arch, since these five are the most significant in arch form.

The area of each arch was calculated by dropping a perpendicular from the incisor point to the molar line, and one from each of the cuspid points to the corresponding incisor-molar line. Three triangles with known altitudes and bases were produced, the combined areas giving the complete size of the arch. The areas of these triangles were then calculated and added together; the difference in area between the arches of each of a pair of twins was computed, and the average area for each pair was determined and used as the base to calculate the percentage of difference in area. This percentage furnished the index of areal difference for comparing the members of each pair, and for comparing the amount of difference in one pair with that in another.

Positional relations of the five landmarks were determined by reference to the molar base-line; that is, the line connecting the central pits of the molars, and by reference to the median line, the perpendicular from the point of proximation of the central incisors to the base-line. (Fig. 2.) This gave four lateral measurements, indicating the position of the cuspids and molars, right and left, in relation to the median line, and three antero-posterior measurements, indicating the position of the cuspids and the incisor point with relation to the molar base-line. The percentage of difference in these measurements in the arches of each pair was calculated by finding the sum of all the difference between the corresponding individual measurements in each pair, and dividing this amount by half the sum of all the measurements of both arches. This percentage furnished an indication of the extent to which the corresponding landmarks in the two arches of a pair failed to coincide. This percentage may be called the index of dimensional difference.

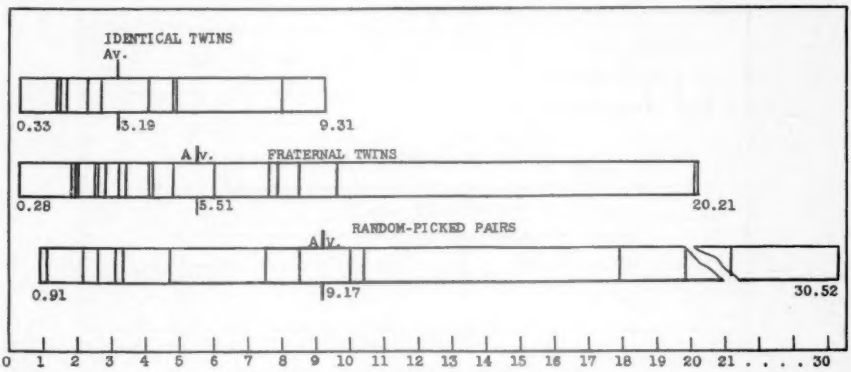

Fig. 4.—Index of areal difference.

This comparison of the linear size of two arches is a comparison of size and shape at the same time. It was thought that influences, such as of sex, might be present in the arch, possibly determining the size of the arch without affecting the shape. For instance, in the case of fraternal twins of different sex, the boy might have

a larger arch than the girl had, but the arches might be of the same shape. In order to eliminate this factor of size, an index of dissimilarity was found. To obtain this, the arch of one twin was reconstructed on a scale in which the molar dimension was made identical with that of the other twin; as follows:

The base lines of the arches were laid at right angles to each other, and the ends connected to form a right triangle, thus producing a nomogram for figuring out relative lengths. By means of this triangle, each measurement of the smaller arch was proportionately enlarged; and an arch drawn to these measurements was superimposed on the larger arch. (Fig. 3.) The same perpendiculars were dropped and the same comparisons made and the percentage of difference was computed.

In order to avoid any possible prejudicial influence on the results, no attempt was made, up to this point in the work, to distinguish between identical and fraternal twins. Now, however, the twins were so classified, according to the criteria employed by H. H. Newman, of the University of Chicago. Although the grouping was not made by an expert on twinning, the results were probably substantially correct. There were found to be eleven pairs of identical twins, and nineteen pairs of fraternal twins.

INTERPRETATION OF DATA

For all three of these indices—areal difference, dimensional difference and dissimilarity—0 per cent represents complete identity. Where only partial likeness exists, the smaller the percentage, the greater the likeness.

Figure 4 gives the results with regard to areal difference for each of the three groups of pairs. The extent of the column in each case represents the range of variation of difference. The amount of difference for each individual case is represented by a line cutting the column. The meaning of the data is, in general, that, as regards areal size of the arch, the twin and co-twin in the identical pairs were more nearly alike than the twin and co-twin in the fraternal pairs. The data also indicate that, as regards areal size, the twin and co-twin, whether of identical or fraternal pairs, were more alike than the members of the pairs without blood relationship. In this connection, it should be recalled that the random pairs had less difference in the size of the base line, in thirteen of the fifteen cases, than had the majority of pairs of either identical or fraternal twins. In spite of this advan-

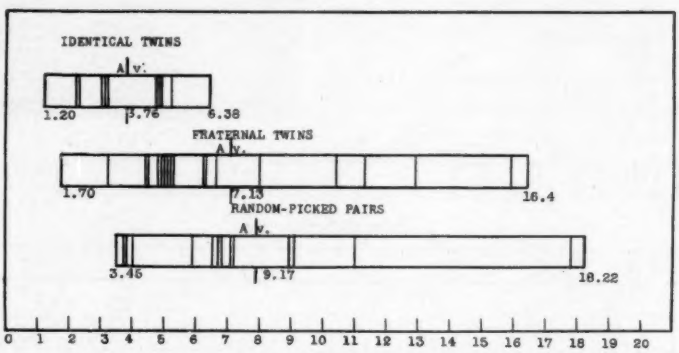

Fig. 5.—Index of dimensional difference.

tage, the random pairs had indices of areal and dimensional difference decidely higher in most cases.

It was found that the twins nearest alike in areal size were more nearly alike than the random pair nearest alike; the identical pair least alike were much more alike than the fraternal pair least alike, and both of these pairs least alike were much more nearly alike than the random pair least alike. The range of variation in areal difference was much less for the identical pairs than for the fraternal pairs; and the range for both the identical and the fraternal pairs was much less than that for the random pairs. The average percentage of difference for the identical group was less than for the fraternal group; and the averages for both groups of twins were less than for the random group.

At the same time, it must not be overlooked that the indices of difference for the identical group were not all lower than for the fraternal group, and the indices of difference for the random group were not all higher than those for either of the twin groups. In fact, about 85 per cent of the pairs in the fraternal group fell within the range of the identical group, and 60 per cent of those in the random group also fell within this range.

Similar results appear in the indices of dimensional difference. (Fig. 5.) Both the lowest and the highest points were lower for the identical group than for the fraternal and random groups. The range was greater for the fraternal group than for the identical, and the averages showed the same greater likeness in the identical group.

Comparable results may also be seen in the index of dissimilarity. (Fig. 6.) The index of dissimilarity was not calculated for the random pairs, but the index of dissimilarity for the identical and fraternal pairs showed the same tendencies as did the indices of areal and dimensional difference. The ranges of variation in the indices of dimensional difference and dissimilarity showed the same overlapping as appeared in the index of areal difference.

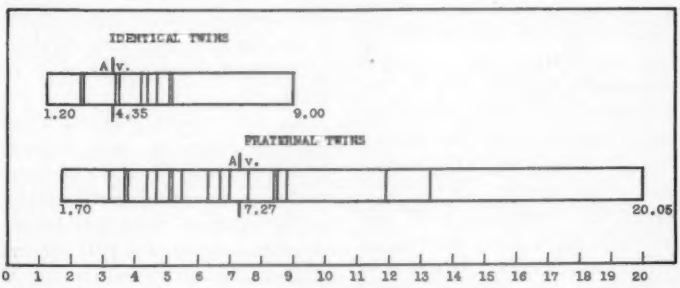

Fig. 6.—Index of dissimilarity.

In connection with these findings, certain questions with regard to the validity of the method employed arose, and it was desirable to determine whether allowance had been made for the possible influence of mirror imagery, if such existed, among the identical twins. The presence of both direct and mirror imagery in the group would affect some of the results, although the comparison of the area of the arches would, of course, be unaffected, since only the total areas were compared, and differences of right and left would not matter.

The method of comparing each dimension of one twin with the corresponding dimension of the other was, of course,

equivalent to assuming direct imagery in all pairs. In order to test this matter, the dimensional difference was calculated for all the pairs of identical twins on the assumption that mirror imagery existed in all of them. The percentages of difference obtained by this method and by the former one were compared, and the smaller index was chosen for each pair. On this basis, six of the cases had a smaller index assuming mirror imagery, and five had a smaller index assuming direct imagery. The range of variation, however, was so nearly the same in the two methods that the influence of mirror imagery, if it existed, was negligible. The implication might be that the arches were sufficiently symmetrical to eliminate the influence of right and left.

Another step in the procedure which might be questioned was the method of constructing the median line, so-called. This anteroposterior base-line for the lateral measurements was obtained by dropping a perpendicular from the incisor point to the molar base-line. The incisor point might, quite possibly, be the most variable of all the landmarks used, and its position the most largely determined by accident or environment. If this were the case, lateral measurements made from such a median base-line would not be representative for the cuspids and molars. As a check on the method employed, another median line was determined by erecting a perpendicular from the midpoint of the molar base-line. Calculations made on this basis, however, showed a range of dimensional difference about the same as that obtained by the first method, and seemed to present no advantage.

It might be objected that, in this investigation, the effect of varying ages was not eliminated. If, for instance, the average age of the fraternal group was much higher than that of the identical group, environmental and accidental forces would have operated in the fraternal group over a longer period of time, and might be supposed to have brought about greater changes in the hereditary pattern, and, therefore, greater differences between the members of a pair, than in the younger group. The range of ages in the identical group was from 6 to 17 years, and in the fraternal group, from 3 to 19. The average for the identical group was 11.4 years, and for the fraternal, 12.2 years. The distribution of ages in the two groups seems to be nearly enough alike to justify the comparisons.

CONCLUSIONS

These studies lead to the belief that the dentures of identical twins are more alike in the three respects studied than are the dentures of fraternal twins or unrelated pairs.

All the results obtained indicate that heredity plays the most important part in determining the size and shape of the dental arch. The heredity of the arches of the identical twins may be assumed to be identical, part for part; therefore, the greater likeness found among them, on the average, is to be expected. The fact that the arches of the fraternal twins were less alike than those of the identical twins, on the one hand, and, on the other, were more alike than those of the random pairs, would indicate that a partially common heredity was influential.

At the same time, since the unrelated pairs revealed likeness in the arches to a considerable extent, it must be recognized that other factors are involved. In the case of the unrelated pairs studied, one of the chief factors was undoubtedly the selection of arches which were nearly of the same size.

1525 East Fifty-Third Street.

SIGNIFICANCE OF ROOT FORM AS DETERMINED BY OCCLUSAL STRESS

By S. J. KLOEHN, D.D.S., Appleton, Wis.

THE dental profession is daily becoming more conscious of the importance of the relationship of the supporting tissues of the tooth to the functioning dentition. It is discouraging to see the bone and periodontal membrane become diseased and destroyed, with a resulting loss of an efficient masticating mechanism. Inability to correctly determine the causes of the pathologic conditions so frequently found in these tissues has made their treatment and the results uncertain. The dental literature is lacking in fundamental information as to the normal relationship between the forces produced during function and the manner in which they are resisted.

The tooth is a tool and the root is the handle by which it is held and through which it receives its support. The handle of any tool should have that form and size which permit most efficient handling and the greatest resistance to forces produced by the working of the tool. In the case of the tooth, the problem would seem to be a determination of the amount and direction of normal stress and an analysis of the sources of the anchorage or support available to withstand this stress. Does the root form, like that of the handle of any other tool, reflect the amount of stress and its direction? If so, one would expect to find dissimilarity in the roots of teeth of dissimilar function. The most logical place to start such an analysis would be in the earliest and most simple tooth forms.

In studying the evolution of teeth, we find that the first form of tooth was the dermoid scale of the shark, which was attached to a cartilaginous rim by fibrous tissue. These teeth are simple cones, extremely sharp, and used only for grasping.

As time went on, there was, we find, increased power in the jaws, with bone replacing cartilage as a medium of support for the teeth. This change was accompanied by a change of tooth attachments, which increased efficiency. Here, we find the first indication of root development. In most cases, at this period of evolution, the teeth were ankylosed to the bone.

The next evolutionary changes were probably variations in the digestive tract and alterations in the defense mechanisms. Both of these were reflected in changes in tooth function and there was a change in crown form and root form and in tooth support. The roots were larger and were placed in alveolar sockets in the bone. They were now attached by fibrous tissue.

Let us first study the general principles governing the support of tooth stress. The stress placed upon the crown is transmitted through the root and thence to the bone around it, where it is resisted. An examination and study of the simple function and the resistance to

From the University of Illinois Graduate Department of Orthodontia.

Read before the Section on Periodontia at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 17, 1938.

the stress as seen in various animal dentures will permit a better analysis of these principles.

The incisor of the rodent is without a doubt the most efficiently functioning tooth in the animal kingdom. It is highly specialized, serving as a tool and as a weapon, and for prehension. (Fig. 1.) The mandibular incisor of the rat arises posteriorly to the last molar, runs in an even arc under the molars and emerges in the anterior portion of the jaw. The maxillary incisor arises anterior to the molar series and forms an arc of a smaller circle as it travels through the jaw, to emerge in front. (Fig. 1.)

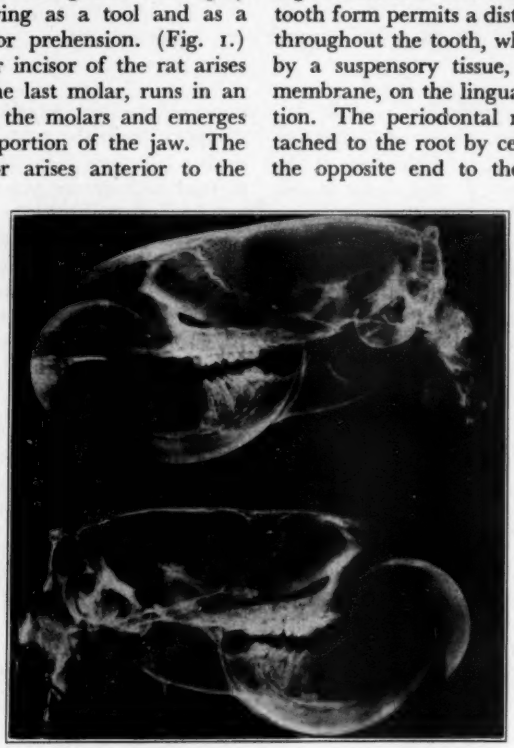

Fig. 1.—Rat head, showing curvature of incisors.

These teeth are covered with enamel only on the labial side, which is the outer surface of the arc. The mesial, lingual and part of the distal surfaces are covered with cementum, to which periodontal membrane is attached. A cross-section measurement of this tooth gives a ratio of enamel surface area to cementum surface area of approximately 3:5. (Fig. 2.) The incisor of the rodent is a tooth of continuous growth and eruption, an adjustment for the rapid wear of its surface. These teeth are shaped in an arc to protect the continuously functioning ameloblasts and odontoblasts. This tooth form permits a distribution of stress throughout the tooth, which is supported by a suspensory tissue, the periodontal membrane, on the lingual and inner portion. The periodontal membrane is attached to the root by cementum and on the opposite end to the alveolar bone, where the stress is finally resisted. The outer portion of the tooth is covered with enamel and the apical one-half with functioning ameloblasts. There is no protective tissue between the enamel and the bone or between the ameloblasts and the bone which could serve as a buffer against any stress directed through this area. This, I think, is conclusive evidence that the periodontal membrane functions as a suspensory tissue rather than as a cushion. The tooth is hung, literally

speaking, in this net work of suspensory strands, which serve as a group of guy wires, tensed by function.

Let us now direct our study of principles to a tooth which has an entirely different form and function, the carnassial of the carnivore. It has only one function, that of cutting food, which, in the case of these animals, is flesh. I used the domestic cat because it is quite typical and easily obtained. The crowns of these teeth are flat buccolingually with

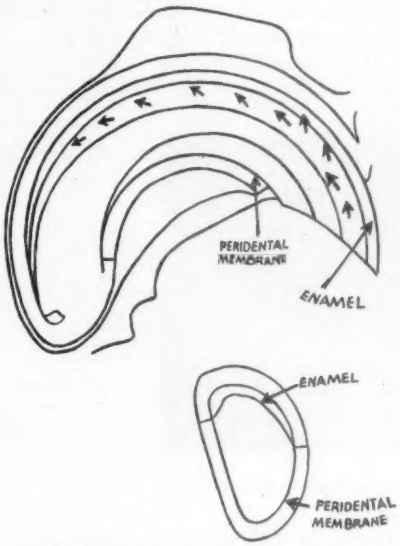

Fig. 2.—Sagittal and cross section of rat incisor, showing periodontal membrane, enamel, dentin and alveolar bone. (After Schour.)

two sharp high cusps set anteroposteriorly. They have an average buccolingual thickness at the gingival line of 2 mm. This tapers occlusally to a knife edge. (Fig. 3.) When the maxillary and mandibular teeth are brought together, the cusps of each make contact first, a diamond-shaped opening remaining, bounded by four cutting blades. In this opening, the food is trapped and cannot escape. The teeth might be compared to two pairs of shears operating simultaneously and thus feeding each other.

It is interesting to note that there is only one pair of teeth functioning at one time. The cutting blades of the maxillary and mandibular teeth are so arranged that when the posterior teeth of the buccal segments are in function, those mesial to them are not in contact. Only after the cutting edges of the most posterior pair have passed each other is it possible for the pair just mesial to them to have intermaxillary contact. The efficiency of this method of occlusion can be readily seen. To place all of the buccal teeth in function at one instant would

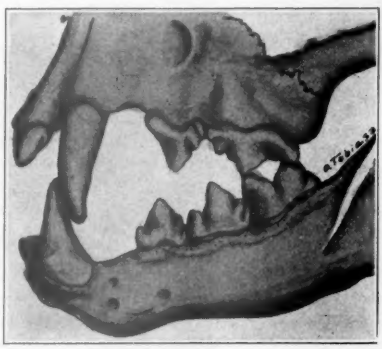

Fig. 3.—Intermaxillary contact in carnassial. (After Brodie.)

demand a great increase of power in the masticating musculature. When power is increased, resistance must be increased. This would necessitate an increase in the medium through which the power is transmitted. An increase of both power and bulk would decrease speed and efficiency in such a cutting and shearing machine.

In a pair of shears, there is a traveling point of contact the efficiency of which depends on the maintenance of a tight contact throughout the stroke. The same principle is necessary in the functioning stroke of the carnassial teeth. The mandibular tooth passes the maxillary tooth

on the lingual surface as it completes the stroke. The stress in the maxillary tooth is toward the buccal surface; in the mandibular, it is toward the lingual surface.

To support these stresses, there are a mesial and a distal root, both of which are flattened buccolingually. (Fig. 4.) They therefore have approximately four times as much surface area on the buccal and lingual surfaces as there is on the mesial and distal surfaces. (Fig. 4.) The stress, being lateral, is expended through the buccal and lingual surfaces of the root. The significance of the flat roots in increasing the efficiency of the suspensory tissue is readily recognized, and is emphasized by the fact that there is the greatest bone development on the lingual side of the upper and buccal side of the lower.

The upper carnassial, which is a third premolar, shows a variation in crown form, having an occlusal functioning surface in the mesiolingual area. This is called a talon and, in most jaws, is only a resting place for the lower molar. The stress on this area is toward the apex of the root. Here, we find a cone-shaped root placed at approximately right angles to the occlusal surface, and this is the best form and position for resistance to the stress placed upon it.

The herbivorous animals, living on roots, grains and grass, present characteristic crown and root forms, which are as different from the group just described as is the diet. For the purpose of the study of this group, I selected the horse. Attention will be confined to the buccal teeth, which include the premolars and molars. The functioning area, or occlusal surface, is composed of enamel, dentin and cementum. (Fig. 5.) The cementum and dentin, having less density, wear down at a faster rate, developing grooves and depressions, between the harder enamel ridges. (Fig. 5.)

The mandibular stroke is in a horizontal direction, traveling across the maxillary teeth from buccal to lingual surface. (Fig. 6.) On superficial examination, the stroke appears to be in a direct buccolingual direction, but this is not so. The mandible travels in an arc from buccal to lingual surface with the condyle of the functioning side as the center of the arc. This might be termed the horizontal arc. Also, an anteroposterior arc is formed by the occlusal surfaces of both jaws. This is due to the variation in height of the teeth and might be termed a vertical arc. We also find a curvature in the buccal segments from mesial to distal aspect, which supplements the arc of the stroke. The arcs of the stroke cause the man-

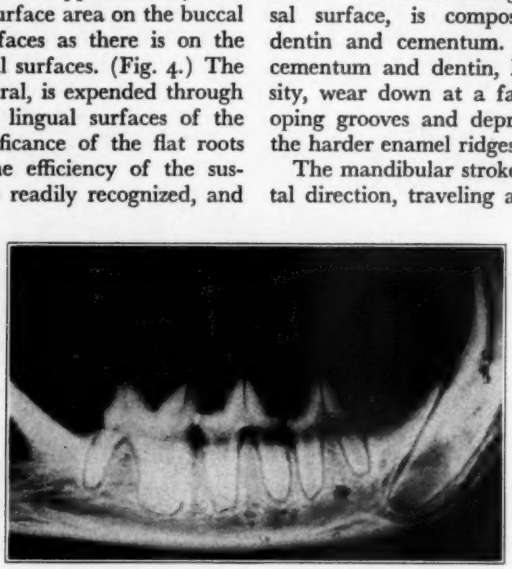

Fig. 4.—Mandibular teeth of cat, showing buccal surface area of roots.

dibular teeth to travel from distal to mesial aspect approximately 20 degrees during the stroke.

The maxillary teeth have an inclination in the buccal direction, but the occlusal surface has an inclination toward the lingual. Thus, the buccoclusal angle is acute. The mandibular teeth have a more perpendicular axial position, but the occlusal surface is lower on the buccal edge and thus an obtuse angle is formed. Therefore, the resultant of the occlusal stress is in a buccal direction in the maxillae, and in a lingual direction in the mandible.

The teeth of the maxillary and mandibular buccal segments have very tight, wide contact surfaces. These contacts are maintained by the mesio-axial inclination of the third molar (Fig. 7), the last tooth of the segment, and by the

Fig. 5.—Occlusal view of upper second and third molars of horse, showing enamel ridges, cementum and dentin and nature of contact. (After Brodie.)

disto-axial inclination of the second premolar, the first functioning tooth. (Fig. 8.) In the segments examined, it was found impossible to remove any of the teeth in the middle portion of the segment without first removing those anterior or posterior to it. They are mechanically interlocked, and appear to function as a unit. Examination of the stroke, however, revealed that they function individually, but lend support to each other as a unit.

The maxillary molars have three roots, a mesial, a lingual and a distal root. The lingual root is flattened on the lingual and buccal surfaces and the mesial and distal roots are flattened on the mesial and distal surfaces. In some cases, the mesial and lingual roots are fused; in others, the distal and lingual roots are fused, whereas in others, all three are fused, only the buccal area remaining open. The roots are flattened and present many grooves; which gives them the appearance of a corrugated plate. These corrugations increase the surface area of the roots.

There are two exceptions to this general root pattern, namely, the mesial root of the second premolar and the distal root of the third molar. These are pyramidal and provide a distal, a mesiolingual and a mesiobuccal surface in the second premolar, and a mesial, a distolingual and a distobuccal surface in the third molar. The second premolar has a distal inclination and the third molar a mesial inclination. This root form pro-

Fig. 6.—Occlusal relations of left buccal teeth at beginning of stroke. (Solid lines, mandibular teeth; broken lines, maxillary.) (After Brodie.)

vides a greater surface area for these two end teeth, which are the only ones that do not have the support of two neighbors.

The mandibular molars have only two roots, a mesial and a distal. The form is similar to those of the maxillae, the roots being flattened mesiodistally and presenting many grooves. Here, the lingual and buccal edges of the root plates either curl in upon themselves or present enlargements at these areas. Either of these increases the area for periodontal membrane attachment from the buccal and lingual surfaces. The mesial root of the second premolar and the distal of the third molar present pyramidal roots almost identical to those of their an-

tagonists in the maxillae. All of these striking modifications in the molars of the herbivorous animals seem to reflect an adaptation of form to the resistance of the functional stress of these teeth. The many grooves increase the surface area for periodontal membrane attachments and the greatest area is provided on the side of pull, or opposite to the direction of the pressure. In the maxillary molars, where the direction of the greatest stress is in the buccal direction, we find a large lingual root with the greatest surface area on the lingual side of the root, and well-developed mesial and distal roots to help support the mesial stress.

There is considerable difference between root form and surface area of the mandibular molars and that of the maxillary molars. This is readily understandable if the functions of these two parts are considered. As Brodie has pointed out, the main function of the mandible is mastication and the structure of the bone reflects this fact. The maxillae have the added function of housing the upper end of the respiratory system and the organs of sight. These demand greater surface area, but must maintain the same strength for mastication. Thus, we find modification in design of the supporting bone to meet these different demands. In masticatory function, the maxillae are stationary, whereas the mandible is the moving portion of the machine and strikes the blow. The maxillae can be compared to the anvil and the mandible to the hammer. The occlusal surface area reflects a difference in function, which will be considered later. From the evidence presented, it can be concluded that the periodontal membrane and bone reflect the arrangement best suited to lend maximum support for the suspension of the tooth, with a minimum expenditure of material.

To better understand the relation of the functioning area to the supporting area, comparative gross examinations of the entire dentures should be made. (Fig. 1.) The denture of the rodent is so arranged that it is impossible for all of the teeth to function simultaneously. When the incisors are in function, the mandible is in a protrusive position, taking the buccal segments out of their intermaxillary contact. (Fig. 8.) To place the molar segments in function, the mandible must be returned to its retrusive position. The difference in the distance between the buccal segments in the maxillae and the mandible and the stroke used makes bilateral function an impossibility. Therefore, we can safely say that the rodent dentition can function only in the right or the left segment at any one time, but not both.

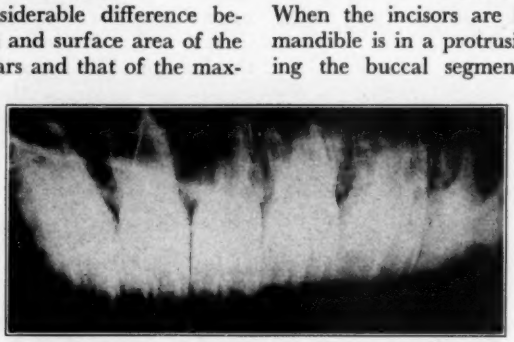

Fig. 7.—Upper buccal teeth of horse, showing axial inclinations.

In the carnivore, the width of the mandibular arch is less than that of the maxillary arch. (Fig. 9.) The molars of the carnivore, as stated before, depend on a tight contact between upper and lower for function, and, to attain this contact, the entire mandible shifts very

slightly to the functioning side. (Fig. 10.) This leaves the opposite side out of contact with its opposing segment. (Fig. 9.) The stroke is preponderantly vertical and the teeth are arranged so that only one tooth in the mandibular and one in the maxillary segment are in function at one time.

In the herbivorous animal, again, the width of the buccal segment in the maxillae is greater than in the mandible. (Fig. 10.) In placing the right molar segment in function, the mandible swings to the right, moving the left condyle forward in its fossa, while the right condyle stays in its fossa, but rotates. It is only when the mandible starts to return to centric position that function begins. At this time, the left side has no intermaxillary contact until the mandible returns to centric position.

The next effort was directed toward the establishment of the ratio between the functioning surface area and the root surface of the teeth. In all cases, the area covered with cementum, to which the periodontal membrane is attached, was taken to represent the root surface. The incisal or occlusal surfaces were measured in order to arrive at an approximate ratio between the two.

In the maxillary incisor of the rodent, the ratio of the incisal functioning surface to the root surface area was found to be 1 :15. The mandibular incisor shows a decrease of root surface area, the ratio being 1 :11.

The buccal segment of the domestic cat shows a variation between the teeth of the upper and those of the lower jaw. The first premolar and the molar of the maxillae are vestigial, the second and third premolars being the only functioning teeth in the segment. The functioning surface area of these two teeth has an approximate ratio of 1 :9 to root surface area. The mandible has two premolars and one molar, all of which function, and the ratio of the functioning surface area to the root surface area is 1 :7.

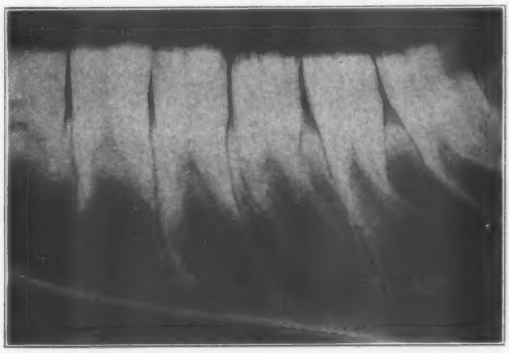

Fig. 8.—Lower buccal teeth of horse, showing axial inclinations.

The dental formula of the maxillary and mandibular buccal segments of the horse is four premolars and three molars. The first premolar of both segments is vestigial and is lost early. The occlusal functioning surface of the maxillary segment has a ratio of 1 :4 to root surface area. The mandibular segment has a ratio of 1 :7. This seems to be a contradiction of the premise that the maxillary ratio runs higher than the mandibular. An attempt to explain this apparent contradiction in the horse led to a more detailed examination of tooth function in general and opened the way for the next phase of the study.

Actual measurement had revealed that although there was more root surface in the maxillae than in the mandible, the ratio was reversed by virtue of the fact that there was almost twice as much occlusal surface area in the maxillary teeth, the upper yielding 4,485 square millimeters to 2,529 for the mandible. It then occurred to us that the smaller of these two figures would have to be taken as representing both upper and lower teeth, since no more than this amount of surface could be in function at any one time. When this ratio was taken, it yielded a maxillary value that was higher than that of the mandible. This raised the question whether we were justified in taking all of the occlusal surface into account in establishing the ratios.

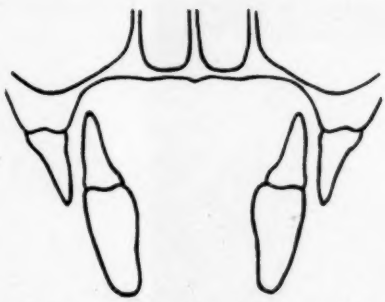

Fig. 9.—Frontal section through carnassials in rest position. (After Brodie.)

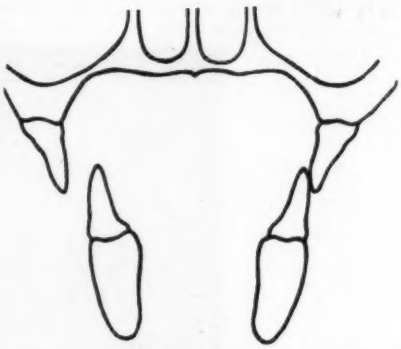

Fig. 10.—Frontal section through carnassials as one pair goes into function. The opposite teeth are well out of function. (After Brodie.)

In the stroke of the rodent, only the enamel edge is in contact at any time during the stroke. By measuring the functioning enamel surface, an area of 2 square millimeters is established for the maxillae and 2.5 for the mandible. The mandibular incisor, the moving portion of this unit, alternates its stroke. In one stroke, the incisal edge of the mandibular incisor travels over the maxillary surface, and in the next stroke, the mandibular incisor surface travels over the maxillary incisal edge. With this correction, the ratio of functioning edge and root surface for anchorage is markedly altered, the approximate ratio between incisal edge and root surface area or anchorage becoming 1 :50.

The carnivorous stroke functions through traveling points of contact, as has been explained. If the length of the functioning edge of the carnassial teeth is multiplied by its width, which is less than 1 mm., a ratio of 1 :50 or more to the root surface is obtained.

In the horse, the mandible is the moving portion of the denture, and at no instant is it possible to have more area of contact in the maxillae than in the mandible; but by increasing the buccolingual width of the maxillary occlusal surface area, the functional efficiency of this machine is increased. The mandibular segment has a greater area over which to work in each individual stroke; which increases the work per unit of time, but decreases speed, which, in the case of this particular animal, is not essential.

In examining the occlusal surface of the molars of the horse, large grooves and depressions were found, separated by enamel ridges of approximately 1 to 2 mm. in width. These enamel ridges are the only places where intermaxillary contact is possible. Thus, it was equally

improper to take the entire surface as a basis for the establishment of the ratio.

The stroke of the horse was found to be mainly a horizontal arc, and at no time during the stroke was there complete contact of all of the enamel ridges of the mandibular teeth. With the use of a depth gage, the height relationship of the enamel ridges from buccal to lingual was measured. (Fig. 12.) The enamel ridges in the middle third portion of the occlusal surface were found to be lower than those of the buccal third and the lingual third. This was true in both mandible and maxillae. Thus, there are

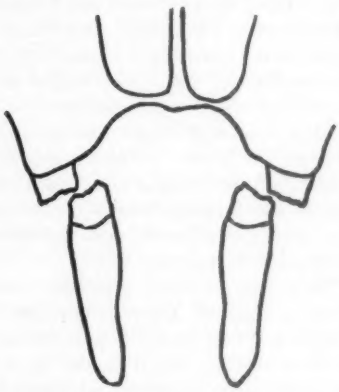

Fig. 11.—Frontal section through molar area of horse with teeth in rest position. The difference in width of maxillary and mandibular teeth is evident. (After Brodie.)

two concave surfaces functioning against each other, an arrangement which never permits more than one-half of the enamel ridges of any tooth to be in contact at any instant. Measuring the surface area of such functioning enamel ridges changed the ratio to approximately 1:40. It should be pointed out that, in the case of these teeth, the roots were measured as though they were smooth surfaces. It is readily seen that the many corrugations would still further increase the ratio.

The purpose of this examination of animal dentures was to determine the principles, if any, of the relationship between occlusal stress and supporting areas. This very superficial study of the problem would seem to indicate that such relations do exist.

In summary, the principles revealed in a study of the animal dentures are as follows:

1. The periodontal membrane acts as a suspensory tissue. The alveolar bone is the recipient of the occlusal stresses and receives these stresses through the tensing

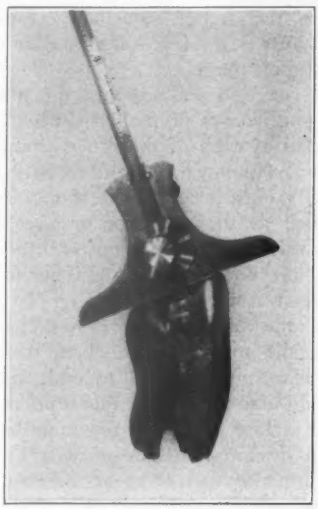

Fig. 12.—Molar of horse with depth gage in position.

of the periodontal membrane. The incisor of the rodent is the finest example of this principle.

2. In animal dentures, at least, each tooth seems to function individually.

3. In no case is the entire occlusal surface of even the individual tooth in function at any single instant.

4. The root form of any tooth reflects its occlusal stress.

5. There is evidence that a uniform ratio between functioning surface and

root surface area may exist, and it appears that this ratio is similar, regardless of the function and stroke, whether in rodent, carnivore or herbivore.

When attention is turned to the tooth of the omnivorous animal, such as that found in man, the problem becomes much more complicated. Thus far, I have found it impossible to even determine, much less measure, the functioning areas that may be in contact at any particular instant. I have therefore had to content myself with an analysis of the general forms of the different classes of teeth, the manner in which they are set in the arches and the vectors and resultants of the forces that are known to play upon them.

In function and support, the tooth of the omnivorous animal presents characteristics of each of the other groups discussed. Human teeth can be divided into three groups according to their function as well as their position in the dental arch: the anterior segment and the right and left buccal segment. The anterior segment is used for shearing. In function, the mandible is moved forward until the mandibular incisors meet the maxillary incisors end to end, and the mandibular teeth then move up the lingual incline planes of the maxillary incisors in completing the stroke. They do not function as true shears because their incisal edges remain parallel. Rather do they resemble the chisel in action. The form of their crowns and the pattern of wear reflect this fact.

The buccal segments somewhat resemble those of the herbivores in function. The marginal ridges have shearing properties and the grooves and various cusps are capable of crushing.

The premolars and molars have larger occlusal surfaces and constitute the true masticating groups. In normal function, the human mandible has considerable lateral excursion. In mastication on the right side, the mandible is caused to swing in this direction by a forward movement of the condyle on the left side, and a rotation of the right condyle. The right buccal segment functions as the mandible swings back to centric position. As the ridges of the mandibular teeth pass those of the maxillary, a shearing action is produced. When the stroke is reaching completion, the cusps settle into the pits and grooves of their antagonists with a crushing effect. The buccal segment on the opposite side does not have intermaxillary contact until the stroke is almost completed and the mandible has returned to centric position.

When the direction of the stroke of the mandible is known, the direction of forces acting on any tooth can be readily appreciated. Thus, the fact that the lower incisor functions against the lingual surface of the upper makes it apparent that there is a labial force on the upper and an equal and opposite lingual force on the lower. In like manner, the pressure of the mandibular buccal teeth against the inclined ridges of the maxillae results in a buccal force above and a lingual force below.

There are certain accessory factors which antagonize these forces and thus contribute to the support and anchorage of these teeth. The first and most important is the continuous arch form. Man is the only animal that has continuous tooth contact throughout the dental arch: all others have two or more diastems. Such a continuous contact lends to each tooth in function the support of all the teeth in that arch. Strict analysis does not tend to support the accepted theory of three-point contact and simultaneous functioning of a number of teeth in any animal denture. In man, it may occasionally happen during a lateral and protrusive movement, but only when there is nothing interposed between the teeth. In studying the arc that the mandible travels during the stroke, and the arch form with its curve of Spee, it would seem that man also has unilateral function. Rather, there seems to be a wave of occlusion in

the buccal segments similar to that in the herbivorous animals. This would mean that each tooth functions individually for an instant as the wave of occlusion passes, but that it receives the support of all the other teeth in the arch through the contact points. The best evidence that such functional forces are resisted at the contacts is seen in those cases in which teeth are lost.

We have all seen the effects of the loss of one or two contact points. For example, if the right central incisor is removed, the left central will move mesially beyond the midline, and the lateral incisor and canine will tend to follow it. The right lateral incisor will move mesially and the canine will do likewise. When a contact point is lost in the buccal segment, it is usually followed by a mesial movement of the teeth posterior to it. We cannot have loss of contact points without loss of normal arch form. Furthermore, loss of contact relationships in one jaw is usually followed by a disturbance of those in the opposing jaw.

The facial musculature also plays an important part in maintaining arch form and tooth contact, and therefore must be mentioned as an accessory to the support to the teeth. Its major contribution is a squeezing action which tends to keep the upper teeth from spreading.

Another force which tends to maintain continuous contact operates through the arch from the second molars forward. This force, termed the anterior component, is the resultant of the mesial inclination of the molars plus the muscular forces.

Let us now turn attention to the design of the teeth themselves to determine whether this factor contributes to maintenance of their positions. The upper central incisors have a mesial and labial axial inclination. Furthermore, the stress of function on these teeth is in a mesial and labial direction. We are not surprised, therefore, to find that the root is pyramidal, having its greatest surface area for periodontal membrane attachment on its mesial, distal and lingual surfaces.

The crowns of upper lateral incisors are normally about two-thirds as large as those of the central incisors. The axial inclinations are very similar. The stress is again in a labial and mesial direction, but there is a lessening of the labial vector due to the position of these teeth and to a decrease in their size. The mandibular canines occlude on the distolingual surfaces of these teeth and the mesial force is increased thereby. The root form reflects this added mesial vector, presenting a greater surface area for anchorage on the mesial and distal as compared to the buccal and lingual aspects.

The mandibular incisors have a labial-axial inclination, but stand almost upright mesiodistally. The stress is in a lingual and distal direction. The lingual stress is largely resisted by the arch form and contact points. The roots are markedly flattened mesiodistally, having about double the surface area for periodontal membrane attachment here as compared to the buccal and lingual surface.

The canine may be considered as a connecting link between the anterior and buccal segments. The axial inclination of the maxillary canine is in a mesial and labial direction. That of the mandibular is more nearly perpendicular, with a very slight lingual and mesial inclination. The greatest stress on the maxillary canine is in a mesial direction and on the mandibular it is likewise. In an examination of their functioning surface, the greatest wear is always found on the distal half. The roots have their largest surface area on the mesial and distal aspects to supply anchorage against these stresses.

The maxillary buccal teeth have a mesial and buccal axial inclination. This axial inclination, together with the curve of Spee and the direction of the stroke, produces stress in a buccal and mesial

direction. The bicuspids are unstable and very often congenitally absent. Their crown form is variable in cusp formation and there is considerable variation in their intermaxillary relationships. The root form of these teeth is correspondingly unstable.

The mesial and buccal inclination of the maxillary molars is in a buccal and mesial direction. The first molar has three roots, a mesial, a lingual and a distal. The mesial root is flattened mesiodistally and presents about twice the root surface area for anchorage here as on the buccal and lingual surfaces. The distal root is very similar in form to the mesial, but smaller. The lingual root is the largest and is flattened buccolingually. It has about double the surface area for periodontal membrane attachment on these surfaces as on the mesial and the distal.

The stresses on the second molar operate in the same direction as on the first molar. The crown is smaller, with a smaller functioning area. The root form is similar, but also smaller. We find a greater variability in the crown form and likewise more modification of root form. The roots are closer together and very often fused.

The mandibular buccal segment is the moving portion of this crushing and shearing unit. The bicuspids play a small part in function as compared to the molars. Because of their variability and instability, their analysis is omitted.

The first molar has a lingual and mesial inclination which results in stresses in a mesial and lingual direction. It has two roots, a mesial and a distal. Both are markedly flattened mesiodistally and present more than twice the surface area for support in this direction.

The second molar is similar to the first in function, crown form and root form. It has less occlusal surface area and also less root surface area. The roots are closer and of greater variability in form.

This completes the analysis of the root form of the human teeth. The findings may be summarized as follows:

1. Evidence seems to point to the fact that the human denture, like those of the lower animals, has a unilateral function, which resembles that found in the dentition of the herbivorous animal.

2. The anterior teeth of the human being function as chisels.

3. The human denture has some accessory elements of support not possessed by lower forms. These are the continuous arch form with full mutual contact and the facial musculature, which afford considerable resistance to the stresses of occlusion.

4. Some general relationships of root surface to functional stress as found in the animal dentures seem to be present in the human dentition. Almost universally, the greatest surface is presented on the side where tension is known to occur.

I should not wish to be understood as considering this presentation more than a preliminary and very superficial survey. The methods I have employed and particularly those for measuring the surface areas were crude. The fact that even such a cursory examination should have revealed any correlation would seem to indicate that this line of investigation is worth following with more exact methods.

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PRACTICAL OBSERVATIONS CONCERNING THE ETIOLOGY OF DENTAL CARIES

By C. A. Scrivener, D.D.S., Ottawa, Kans.

CURRENT theories concerning dental caries are being continually attacked. Practical observations strengthen the doubt as to their reliability. The correlation of knowledge gained by dentists in their practice may, perhaps, assist in doing away with this almost universal pathologic condition.

In considering the possible causes of caries, a study of the disintegration of the inorganic structures seems most important, and no present-day theory deals satisfactorily with this phase of the subject, especially with those conditions commonly known as abrasion and erosion, which are not usually associated with caries in its most common form.

Although we have little definite knowledge concerning caries, we are at least certain of a few facts: 1. Caries never originates below the attachment of the peridental membrane. 2. The progress of decay ceases with death or with extraction of the tooth. 3. Clasps or orthodontic appliances sometimes encourage decalcification. 4. Decay does not usually occur beneath deposits of salivary calculus. 5. Impacted teeth do not decay without external communication. 6. Deep hypoplastic enamel pits and areas of discoloration (apparent decalcification) in some mouths show no predisposition to decay. 7. No surface unreached by saliva is susceptible to decay. 8. Segregation of the tooth from saliva halts the progress of decay.

There are still many facts about caries which we need to learn. A fundamental principle of chemistry teaches us that nothing in Nature is destroyed, but that substances are merely changed from one chemical state to another by the altering of surrounding conditions. Thus, wood in burning is changed into ash and gas. So it is with caries.

1. We should have a complete and definite knowledge of the chemical composition of various types of decay. Does the leathery or soft decay found in some carious areas contain calcium phosphate and other inorganic salts, or is it only the disintegrated organic substances that are found in both dentin and enamel?

2. We should have a complete comparative salivary analysis of the immune and of those having rampant caries.

3. We should know the effect of the saliva of an immune person on cultures of bacteria isolated from caries of a susceptible person.

4. We should know the effect on caries of introducing *B. acidophilus* and associated bacteria isolated from carious teeth into the blood stream (immunization by vaccine).

5. We should have an analysis of dental decay in comparison with the decomposition or the disintegration of other substances, especially of other organic calcium substances; for instance, bones left exposed to the elements for long periods of time, as well as bones of human beings exhumed after long burial.

6. We should be able to produce decay in the test tube by immersing a tooth in a bacterial culture or by otherwise artificially creating a condition favorable to decay in unnatural conditions.

If facts are available as a result of experiments such as those suggested, they

have been given little consideration or publicity, and they are facts that would be helpful in furthering the control of caries.

Pure water is generally recognized as the universal solvent. Few substances are absolutely insoluble in it, and this number is greatly diminished when certain other elements are added to water. For instance, gold is practically insoluble in water, but becomes readily soluble when a small percentage (3) of sodium or potassium cyanide is added. Again, limestone (calcium carbonate), its permanence recognized by its wide use in building construction, is only slightly soluble in water, but becomes readily soluble with the addition of a small amount of carbon dioxide. Conclusive evidence of numerous other similar instances we find in the study of various geologic formations. May not the process of dental deterioration and the formation of calculus be compared to the geologic formation of limestone caverns with their stalactite and stalagmite formations? The dissolution of the calcium carbonate is brought about by the presence of carbon dioxide in solution and the deposition is created by the solution becoming supersaturated by the loss of carbon dioxide on exposure to the atmosphere.

That saliva contains a solvent for calcium phosphate (the principal inorganic salt of both enamel and dentin) is in evidence, since salivary calculus, theoretically an inorganic precipitate from the saliva, contains chiefly calcium phosphate.

Nature has provided means for healing all organic tissues of the body. Has she provided this protective inorganic matrix to make healing of tooth structure unnecessary? And have we failed to discover the condition which destroys the inorganic tissue and thus deprives our teeth of this protection?

We frequently employ the blood stream to immunize our living tissues against pathologic conditions. Circulation around each cell makes this possible. It is therefore logical that a substance contacting each surface of the teeth and induced into each fissure, enamel defect and faulty margin by capillary attraction should have a marked influence as regards the preservation or deterioration of the dental organs.

Much time and effort have been spent on research involving the organic structures, but little work has been done in looking at caries from a strictly inorganic angle. At present, the theory of corrective diet seems most popular. But why, if it is the result of a strictly dietary deficiency, should not decay start at the pulp chamber, the site of nutrition of the tooth, and progress outwardly? Why should not impacted teeth show the same tendency to rampant caries as do other teeth in the same mouth, and why should not pulpless teeth decay more rapidly than vital teeth? We all see instances in practice of patients on the most perfectly balanced diets and in whose teeth decay makes rapid progress. The results are not uniform and therefore not entirely dependable. That much progress has been made toward the elimination of decay by corrective diet is not to be disputed, but it is not impossible that the direct effect has been on the salivary secretions and that carious processes have been diminished by the creation of a more favorable habitat for normal tooth structure. It seems unreasonable that Nature intended our diet to be so carefully balanced that it is necessary for us to consume a quart of orange juice or its equivalent each day together with other requisities in order to be immune to caries. For every individual to secure a perfectly balanced diet is geographically impossible despite our excellent means of modern transportation, and, for this reason, another more dependable, effective and less costly means of combat must be found before we can be immune to caries.

The disintegration of inorganic sub-

stances in dental caries is undoubtedly independent of the disintegration of organic substances. In preventing the destruction of the protective inorganic matrix, danger of destruction of the valuable organic structures of the tooth may be minimized. It seems probable that some salivary reaction causes dissolution of the inorganic salts of the enamel and dentin, leaving the organic constituents exposed to the natural processes of organic decay. We are all familiar with the result of decomposition of meat and other food débris that has collected in cavities formed beneath holes worn in crowns or similar prostheses. This approximates all organic decomposition, but the process is catalyzed in the mouth owing to the ideal conditions of temperature, darkness, dampness and bacterial proliferation. The foregoing statement approximates the generally accepted theory of Miller, but apparently applies only to the deterioration of organic tissues.

The knowledge of the effect of epinephrine in reducing the flow of saliva and the more recent discovery of acetylchlorine, a secretion of the ganglia of the parasympathetic nervous system, which greatly increases the flow of saliva, suggest that the endocrine glands affect at least the flow of saliva and perhaps its chemical constituents as well.

The conclusion to be drawn from the foregoing considerations is that caries may be primarily the result of a pathologic condition of the saliva, the dental structure being incessantly bathed in the disintegrating solution. The presence of bacteria, malformation, dietary deficiency, hypoplasia, prophylaxis and endocrine deficiencies probably all are factors, but if the inorganic matrix remains intact, owing either to the presence in the saliva of an immunizing agent or to the absence of a deteriorating agent, the remaining factors appear to be negligible. The pH concentration and the presence of carbon dioxide, ammonia or cyanites in saliva apparently have little bearing on the carious process, but some element or compound not yet detected is probably present.

Neither should we overlook the possibility of the known deteriorating effects of galvanic reactions in electrolytic processes. That galvanic activity is present in most mouths is a fact of which we are all well aware. Since this is also a subject about which little is known, further research will undoubtedly cast light on many unsolved problems.

Caries-immune persons may be divided into two groups: those whose teeth are habitually clean (free from both caries and calculus) and those whose teeth are free from caries, but show a marked tendency to heavy calculus deposits in spite of excellent home care and frequent office prophylactic treatment. Assuming that human saliva may contain a solvent for inorganic tooth structure, we may conclude that this substance is absent from the saliva of those in the former group. The saliva of those in the latter group contains the solvent, but is kept supersaturated by inorganic compounds similar to those found in tooth structure. Consequently, the tooth structure is not attacked, but calculus is abundant, and pyorrheic conditions usually exist. The assumption of the existence in the saliva of an inorganic solvent and of the effect of its presence or absence on the two groups of the caries-immune suggests two methods of immunization against dental decay. The first and more desirable method is that of discovering and eliminating the solvent from the saliva. The second, to be used in case the deteriorating substance cannot be recognized and eliminated, is that of finding the control by which the amount of inorganic salts in the saliva may be increased and of keeping the saliva so saturated that it will no longer act as an enamel solvent.

Recent experiments at Northwestern University have definitely revealed a dif-

ference in the calcium solvent properties of the saliva in the caries-immune and the caries-susceptible; but these investigations leave out of consideration the fact that the primary substance attacked by the solvent may be some element other than calcium that is contained in the enamel.

Surely it is within the scope of modern science to discover the channels through which dental structures are being attacked by disease, and to make provision for the complete abolition of caries by the development of a practical immunizing agent.

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Masonic Building.

STUDIES IN ADAMANTINOMA

By Lester R. Cahn, D.D.S., New York City

THE fact that "adamantinoma" has so many synonyms shows that its pathology and etiology are little understood. Among the names suggested are: multilocular cystic tumor, epithelial odontome, fibrocystic tumor of the jaw, cystic epithelioma, cystic sarcoma, cystic adenoma and proliferating follicular cystoma.

Our great fault has been that we have considered adamantinomas as histologic curiosities rather than as true neoplasms.

With regard to the exact site from which these tumors arise, a number of views have been expressed. Some believe that they represent an abnormal development of the enamel organ; others think that they originate from an ingrowth of the epithelium of the gum, and there are those that attribute their origin to an overgrowth of the paradental epithelial remnants (epithelial débris of Malassez).

(Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 13, 1937.)

According to the majority of current opinions, the adamantinoma arises in connection with the epithelium which is particularly associated with tooth development, but no definite statement can be made as to which particular cells form the tumor and whether they originate in the enamel organ, which seems to be the most common site, or in other parts of the tooth band. Basal cells appear to play the most active part, and for this reason Krompecher has suggested yet another name, "basiloma."

In studying some sections of large recurring adamantinomas, it appeared that the tumor arose from the basal cells of the overlying mucosa. It is such a histologic picture that has given rise to the theory that these neoplasms are derived from the epithelium of the gum. In all probability, the reaction of the overlying epithelium was increased by the approach of the underlying growth, and the tumor, as it neared the surface, blended with this tissue. (Fig. 1.) In one specimen that I examined, the reaction of the gingival mucosa was so intense that the structure

was almost indistinguishable from a basal-cell carcinoma.

The best clue to the origin of the adamantinoma may be had from a study of extra-oral adamantinomas, rare tumors found in the neighborhood of the pituitary gland and on the anterior surface of the lower leg.

The pituitary adamantinoma, technically called a craniopharyngioma, probably has the same origin as its counterpart in the jaws, because the craniopharyngeal duct is derived from the oral epithelium of the embryo, from which also arises the dental lamina and the enamel organ. Pituitary and oral adamantinomas (Fig. 2) are similar in structure. Grossly also they have like characteristics as they may occur in a cystic form with papillomatous wall tumors. (Fig. 3.)

The craniopharyngioma is considered an epithelioma and is looked on as a malignant neoplasm. Although it is granted that it occurs in a much more vulnerable area than does the jaw tumor, it is not the site of growth, but its structure, that has led pathologists to consider it an epithelioma; and since its origin and structure are probably one with the jaw lesion, it would be just as logical to designate the latter also as an epithelioma.

The tibial adamantinoma is a very rare tumor of unknown origin. There is usually a history of trauma associated with this growth, and it results supposedly from an implant of skin epithelium, which grows and takes on the characteristics of a neoplasm. Edema occurs in the solid sheaths of cells, giving them the appearance of the stellate reticulum of the enamel organ.

From the histories reported in the literature and in the one case that I was

Fig. 1.—A photomicrograph showing the blending of the underlying epithelial growth with the covering mucosa. A picture of this kind has given rise to the theory that the origin of the tumor is from the basal cells of the overlying mucosa.

able to study directly from the tissue, I saw no similarity between the jaw adamantinoma and the craniopharyngioma and these tibial tumors, except possibly the similarity to stellate reticulum of the edematous epithelial cell groups. This very change may, of course, suggest the cause of the simulation of the stellate reticulum in the adamantinomas of the jaws and pituitary region. A similar construction, due to edema, is also seen in the rodent ulcer, which is unquestionably a basal-cell epithelioma of the skin.

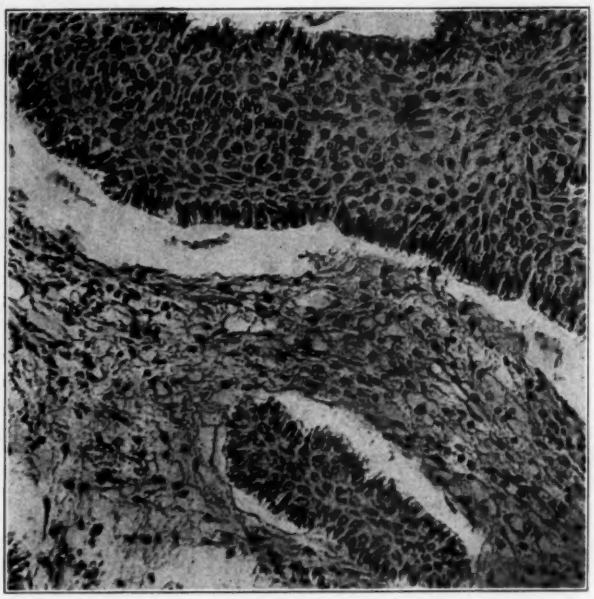

Fig. 2.—The microscopical structure of the craniopharyngioma (pituitary adamantinoma). Note the columnar peripheral cells which bear a close resemblance to the adamantoblast. Compare the structure of this tumor with that of the mandibular adamantinomas shown in Figures 6 and 8.

The very word "adamantinoma" is in itself misleading. No one has reported finding enamel in these growths. Possibly the term adamantoblastoma may be more technically correct, but all these terms are academic and are certainly no help to the clinician, often misleading him. If it were called an intra-osseous basal-cell epithelioma, and that is what it really is, it would not be so lightly regarded and carelessly handled.

The primary cystic adamantinoma is the most interesting of the various types occurring in the jaws. It may appear to be an ordinary root-end cyst or, at times, may contain a tooth, when it closely resembles a dentigerous cyst. Not infrequently, it may contain mural papillary tumors. (Fig. 4.) Histologic diagnosis is necessary to distinguish the cystic adamantinoma from the innocuous dentigerous cyst. (Fig. 5.)

I have a number of times observed the recurrence in solid, more malignant forms of adamantinomas, which were first removed as so-called dentigerous cysts. Incomplete operation due to ignorance of the underlying pathology was the cause of the recurrence. The mural

tumors are very often lightly attached to the cyst wall and may drop into the operative wound, where they slowly grow. These intracystic growths are very much like another type of brain tumor, the

Fig. 3.—Papilliform excrescence in the wall of a cystic craniopharyngioma. Compare this picture with Figure 4. (Taken from Bailey's "Intracranial Tumors.")

the cystic fluid has an inhibitory influence on the growth of these mural tumors.

If one keeps in mind that any cystic

Fig. 4.—Mural excrescence in the wall of a so-called dentigerous cyst. The structure of this papilliferous growth was that of an adamantinoma. (Taken from "The Report on Odontomes." Published by the British Dental Association).

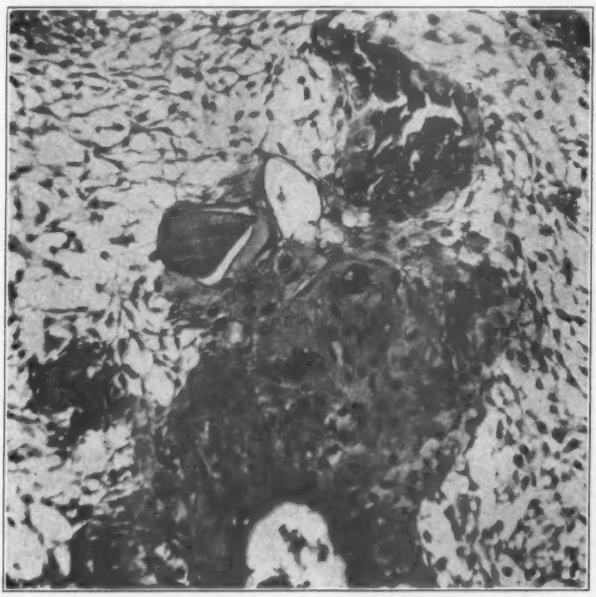

Fig. 5.—The structure of a recurrent adamantinoma. This is a higher-powered view of the tumor shown in Figure 1. This was the third recurrence. Note the squamous transformation of the central cells. They have assumed a more malignant aspect.

astrocytoma. This also occurs as a cystic growth which, if simply drained of its fluid, will recur in a solid form. Possibly tumor of the jaw may be an adamantinoma, the question of diagnosis becomes a live one. (Figs. 6, 7, 8.)

The x-ray picture is of great aid if correctly interpreted. Irregularity of the cyst outline, together with erosion of the adjoining teeth, should create suspicion.

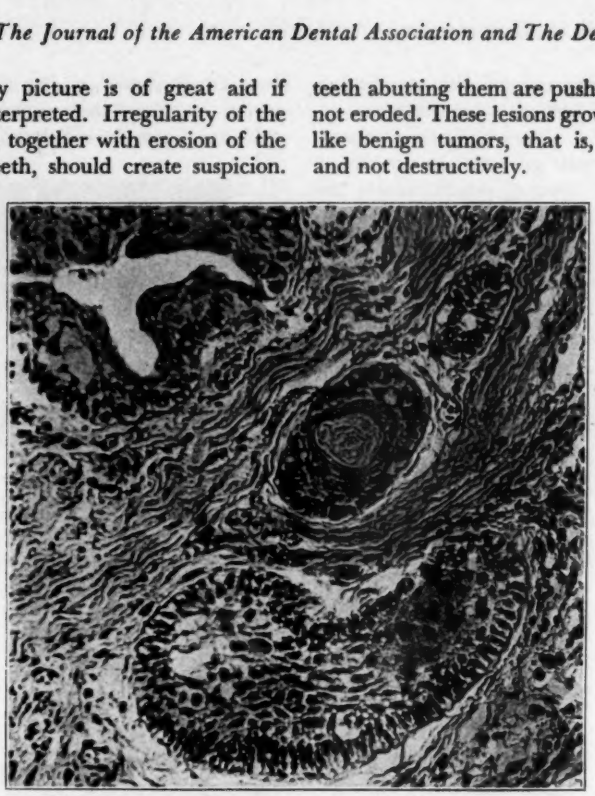

Fig. 6.—A section of a mural papilloma found in the wall of a so-called dentigerous cyst. Note the adamantinomatous structure of the islands of epithelium and the squamous metaplasia of the center of these masses.

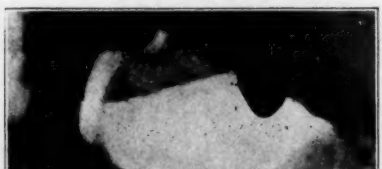

Fig. 7.—A roentgenogram of a recurrent cystic adamantinoma. The primary lesion had been removed as a dentigerous cyst.

Dentigerous or benign radicular cysts usually have clear cut outlines and the teeth abutting them are pushed aside and not eroded. These lesions grow very much like benign tumors, that is, expansively and not destructively.

Aspiration of the tumor contents may also prove of assistance in a preoperative diagnosis. However, in most instances, a positive opinion can be had only after a histologic examination of the cyst membrane. The presence of basal columnar or adamantoblastic epithelium is diagnostic of a cystic adamantinoma. Every cyst membrane must be histologically examined. Too strong emphasis cannot be placed on this statement.

The question often arises as to whether the adamantinoma is a benign or malignant tumor. It is certainly not benign, nor is it strongly malignant. If not removed thoroughly, it will recur in a more malignant form, but fortunately metastasis is not frequent, although there

are on record a number of cases in which fatal infiltration and metastasis have taken place.

The treatment depends entirely on a correct diagnosis and proper understanding of the pathology of this neoplasm. If it is borne in mind that the adamantinoma is really an epithelioma, the treatment will be more successful.

In the extensive cases, especially in a recurrence, resection of the jaw offers the best prognosis. In the less extensive ones, curettage, followed by chemical, thermal or electrical cauterization of the operative wound and irradiation, is the treatment of choice. Not enough work has been done with this particular tumor in regard to radiotherapy to warrant any conclusions, but it is a field worth investigating.

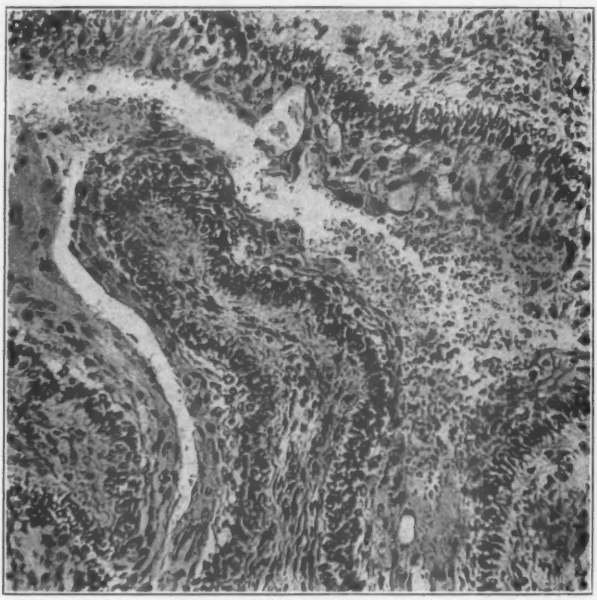

Fig. 8.—A section of the tissue removed from the lesion shown in the previous picture. Note the columnar peripheral cells and compare them with those seen in Figure 2.

CONCLUSIONS

The adamantinoma probably arises from the epithelium particularly associated with tooth development, the basal cell, the adamantoblast, being the most active cell.

The tumor is an epithelioma of the basal-cell variety.

Its most baffling form is the cystic type, when it resembles the radicular or the dentigerous cyst.

Successful treatment is entirely dependent on correct diagnosis.

Diagnosis is made by means of the x-ray and the histologic examination of the cyst membrane.

Every cyst membrane should be microscopically examined.

The treatment consists in eradication of all the neoplastic tissue. This may be done by surgery alone. Surgery plus irradiation is probably the method of choice.

944 Park Avenue.

THE SEVENTH CRUISE-CONGRESS OF THE PAN-AMERICAN MEDICAL ASSOCIATION

By Alfred Walker, D.D.S., New York City

THE formation of a Section of Dentistry of the Pan-American Medical Association was first suggested when the Congress of the Association was held in Mexico City in 1931. As an initial move it was proposed that a paper on a dental subject be read at the Congress. No action was taken at this time because of the inability of the parties invited to participate. In 1936 another invitation was extended to present a paper at the Congress, which in that year was held in Rio de Janiero, but again, and for the same reason, the invitation was declined.

However, the advisability of forming a section of dentistry continued under consideration, and when plans were being made for the Seventh Cruise-Congress (1937), a formal invitation was extended to organize a dental section and to participate in this event. The invitation was accepted and the organization of the section effected. The following officers were elected:

President: Alfred Walker
Vice-Presidents:
James T. Ivory
Harry E. Kelsey
Raul Masvidal
B. B. McCollum
Marcus L. Ward
Leo Winter
Secretary: Wm. H. Parke
Executive Committee:
Theodor Blum
Leroy L. Hartman
Martin C. Tracy
C. Raymond Wells
William W. Woodbury
Latin American Relations Committee:
J. M. Renedo
Horace L. Cartee

The itinerary provided for four and one-half days and five nights in Havana, where the Congress was held; then to Port au Prince, Haiti, to remain about eight hours; then to Trujillo City for about ten hours and then to San Juan for about ten hours.

On January 15, 1938, two hundred and sixty physicians and nine dentists with their families embarked on the luxurious liner Queen of Bermuda. The passage from New York to Havana was delightful and without notable incident. Social activities and the discussion of plans for the Congress were the daily routine.

Dr. J. M. Renedo, Chairman of the Committee on Latin American Relations of the Section of Dentistry and Oral Surgery, had preceded the party and arrived in Havana on the 12th instant and assisted the local committee in perfecting arrangements for our part in the Congress. Immediately upon docking, the local committee came aboard and extended most hospitable greetings. The plans for the formal reception had to be changed because the day of our arrival was given over to the funeral arrangements for the seven Cuban aviators who had lost their lives in the good-will flight to Columbia.

Following the formal greetings aboard the boat, the local committee, Doctors de Varona, Renedo, Weber, Rocafort and Horta, escorted our party to the

Congress headquarters at the Hotel National. The afternoon was given over to social activities followed by an informal dinner. Over one thousand attended the opening ceremonies of the Congress, which were held in the grand ballroom that evening. Official greetings from the representatives of the Cuban chapter of the Pan-American Medical Association were followed by the presentation, to each section chairman, of a beautiful gavel made from native wood. The presentations were made in alphabetical sequence, the Chairman of the Section of Dentistry and Oral Surgery being the third introduced and presented.

The sessions of the medical sections were held at the National Hotel and those of the dental section at the splendid quarters of the Cuban Stomatological College at Prado 10. The literary sections were held from two to six each afternoon, with an average attendance of from seventy-five to eighty throughout each day. The practical demonstrations were given in the mornings at the Havana Dental College, where every facility was provided by Dean Biado and his staff. The members of the Havana chapter of the dental section had worked diligently and effectively in arranging for the very smooth running of the Congress. The visiting dentists were entertained at luncheon on successive days at the Havana Yacht Club, the Miramar Yacht Club and the Tennis Club.

The plenary sessions of the Congress were held in the beautiful Academy of Sciences, of which Dr. Andres Weber, who is well known to dentists all over the world for his interest in dental literature and for his unexcelled library, is librarian. Some of us enjoyed the rare opportunity to visit his home and see and hold in our hands some of his rare dental and medical volumes.

The Congress concluded its sessions on Friday, January 21, and following the closing exercises, the Stomatological and Odontological Societies went into formal session and presented certificates of corresponding membership in the Odontological Society of Cuba to the officers of the section who participated in the Congress, Alfred Walker and Leroy Hartman. Following this, the visiting officers and those who participated in the program, Jacob Zweig, William Paul, John E. Nyman, Harry B. Wright, Leroy L. Hartman and Alfred Walker, were made corresponding members of the National College of Stomatology of Cuba, as was also Clayton Peet of Peekskill, New York, who was in attendance at the meeting.

Saturday, the last day in Havana, was given over to entertainment. Cars were provided for about eighty, and at 10:00 a.m. we started for Rosario, a large sugar plantation about fifty miles from Havana. Under a thatched roof pavilion on the Club grounds we sat down to a beautiful and most enjoyable luncheon. Native music, dancing and genuine merriment were the order of the day. That evening we entertained our Cuban hosts and their families at a dance and buffet supper aboard the boat. Reluctance to terminate the party and lingering leave-taking caused a delay of fifteen minutes in our departure. The registration of the Congress totaled 1,500.

At Port au Prince, the next stop, which we reached on the morning of January 24, we were met at the wharf (the ship did not dock) by Dr. J. Thebaud, Dean of the dental school, and Mr. Williams, President of the Bank of Haiti, who drove us about town and took us to his beautiful home, where we met the charming Mrs. Williams. Dr. Thebaud, a dentist, is treasurer of the local chapter of the Pan American Medical Association and was chairman of the committee which provided the afternoon entertainment for our visit. For this purpose autos were provided and we were driven to the country club up in the hills, a charming

place overlooking the beautiful harbor and surrounding hills.

The club activities center about the two story pavilion with adjoining tennis courts and swimming pool. Here we were most hospitably greeted by the gracious and delightful young lady hostesses who had provided a never-to-be-forgotten entertainment. On the lawns surrounding the pavilion were long tables laden with a great variety of foods in the form of salads, assortment of cooked foods, cakes and pastries, which, we were informed, had all been prepared in the homes of the members. In addition there was an abundance of wine, and other beverages. Other tables were weighted down with every variety of native fruit. On the upper floor of the pavilion a band provided music for dancing. A more enjoyable occasion would be difficult to imagine. The weather was delightful. Although we were the official guests of the government, no incident following the reception at the capitol had any trace of formality. The hospitality was genuine and enthusiastic, so much so that it was with great reluctance that we departed.

Although the scheduled program was a full one, some of us did find time to visit the splendid little dental school. Dr. Thebaud's office close by is modern, complete and attractive. His home, to which we made a short visit, is situated well up in the hills and overlooking the harbor, his rose garden yielded generous contributions to our already well laden arms, and his cellar provided for a farewell toast to an ever-to-be-remembered visit.

Just before sundown we got under way for Trujillo, Dominican Republic, which we reached on the morning of January 26. Here again we were most warmly received. Dr. Aybar, dentist to the President and also speaker of the Senate, came aboard as soon as the ship docked and took us in charge. We were driven to the capitol, where formal ceremonies, with appropriate toasts, were the order. In these countries the wine that sparkles is an essential part of formal ceremonies regardless of the time of day. On this occasion the hour was 9:30 a.m. After additional formal ceremonies at the Senate Chamber, a visit was made to the cathedral, where it is claimed the bones of Christopher Columbus still repose. There is considerable controversy concerning this, but there is no doubt that the Dominican Republic believes it possesses the bones of the discoverer of America.

We were then escorted about the city, visiting the shops where products of native craftsmanship, principally mahogany wood carving, abound. We very quickly learned that to admire anything was to find oneself the possessor. From then on purchasable objects were admired in silence.

The Dominican dentists and physicians and their wives were our guests for luncheon aboard ship. For the afternoon we were taken to the splendid Pargue Ramfis, the children's playground, which occupies a large area on one of the high levels of the city overlooking the sea. It consists of a spacious and modernly equipped playground, a huge swimming pool and a very broad plaza surrounded by pavilions. In front of the pavilions our hosts had set tables laden with an abundance of food, fruits and beverages. Two bands provided music. Dancing and dining were the order of the day, which came to an end all too soon.

It was with much regret that we cast off, for here again we were deeply touched by the genuine hospitality and good feeling which prevailed. It would be difficult to imagine a cleaner city than Trujillo. It is a veritably spotless town; they actually scrub the walks in the park with soap and water.

At San Juan, Puerto Rico, the welcoming committee, Doctors Santibanes and

Becerra, received us with touching hospitality, following a formal reception and ceremonies at the Governor's house. We were shown about the city, and visited the School of Tropical Medicine, which is housed in modern buildings and ably directed by Dr. George Bachman. This school is financed by the United States government and its affairs are administered by Columbia University. The school authorities provided an interesting exhibit for us, and we were able to gain some knowledge of the many and serious problems that confront medical practice on this island and in the tropics generally.

The dental profession in Puerto Rico is well organized and is on the alert to meet any problems that arise. Those whom we had the pleasure of meeting showed a genuine interest in the development of closer relations between our organization and their own. The Dental Section of the Pan-American Medical Association affords a splendid opportunity to further closer affiliation. A drive through the city and outlying country added much to the delightful but short visit at Puerto Rico.

The return voyage was crowded with activities, both social and professional. The program called for round-table discussions and formal talks. The members of the dental section participated in these activities and found them interesting and helpful. The weather was extremely favorable, enabling us to hold many of our round-table discussions on the open decks.

The 1938 Cruise-Congress of the Pan-American Medical Association, the first in which the Section of Dentistry and Oral Surgery participated, was its most successful. We who represented the dental section are highly gratified by the interest and enthusiasm shown by our Latin-American colleagues and are very appreciative of the fine fraternal spirit so frequently displayed by the Director and officers and members of the Pan-American Medical Association.

While from the purely professional standpoint we were able to accomplish much, the relationships and friendships established have broader and, to our minds, more important implications. In these days of international strife it was stimulating and encouraging to encounter the genuineness and warmth of the hospitality, the depth of feeling and evidence of sincere appreciation which prevailed wherever we went. There can be no doubt that the Pan-American Medical Association, through its international activities, has become a premier good-will agency.

501 Madison Avenue.

THE JOURNAL *of the* AMERICAN DENTAL ASSOCIATION *and* THE DENTAL COSMOS*

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Published by the American Dental Association
212 East Superior St., Chicago, Ill.

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to non-members is $5.00 a year in advance, this rate applying to both domestic and foreign subscriptions. All foreign subscriptions are to be paid in United States money.

*In deference to the wish of the dental profession to control its literature, *The Dental Cosmos*, founded in 1859, was transferred by the publishers as a gift to the American Dental Association, January 1937.

Editorial Department

A $5,000.00 LEGACY TO THE RELIEF FUND

THE following letter will be read with interest by our members:

American Dental Association
212 East Superior Street
Chicago, Illinois
Attention: Mr. L. T. Claridge, Business Manager
Dear Mr. Claridge:

I am enclosing check 2395 drawn on the First National Bank, Alexandria, Va., in the amount of $5,000 which is a legacy bequeathed by the late Dr. Thomas L. Rust to the Relief Fund of the American Dental Association.

You are hereby instructed and authorized to deposit this check in the Relief Fund Account.

Yours sincerely,
American Dental Association
(Signed) R. H. VOLLAND, *Treasurer.*

This is very gratifying information. Ever since the Relief Fund was inaugurated, there has been a steady growth of interest in this enter-

prise. Few activities of the American Dental Association have elicited so wide a sentiment of approval as this, and few have functioned so successfully.

The Fund has now grown to approximately $405,000, and today the beneficiaries are receiving more than $20,000 a year in relief.

The widespread effect of this beneficence can hardly be estimated. It is not only the concrete good that is being done to unfortunate members, but, it is fair to say, it is also the wholesome sentiment of the movement that has added immeasurably to the *esprit de corps* of the entire organization.

Incidentally, it may be well to remark once more on the very efficient manner in which this enterprise has been administered. From the very beginning, the movement has been favored by having men at its head with devotion and vision, and thus the welfare of the Association has been safeguarded in an unusual manner.

In addition to the good that has been done in the way of relief to our unfortunate members, there has been an additional benefit of equal value in the creation of good will throughout the organization. Men have been made to feel that there is something to be gained by membership in the American Dental Association aside from the tangible benefits of financial aid to the needy. The fact that our members realize that there is a bond of fellowship in our organization that holds our membership together in a common purpose really means more for the welfare of the whole body than any single act of benevolence.

Through the agency of the Relief Fund, the sympathies of our members have been quickened along many lines. It is not merely the fact that the unfortunates have been succored and relieved of anxiety and, in some cases, of actual suffering: it is the feeling that there is, in our midst, a sentiment of comradeship that has made one member feel toward another in a way different from his feeling toward his ordinary fellowman.

This sentiment has had a distinct value in our organization. It has made our members feel not only that it is their duty to be faithful to one another, but also that it is a pleasure to be identified with men of this common character. The reputation of the American Dental Association has been immeasurably enhanced because of the fact that the members have taken pride in the realization that not only do they belong to an organization that exhibits the ordinary business acumen that is required of a large body such as ours, but also that, with it all, there

is manifest a deep-seated recognition of the vital need for subscribing in a very intimate way to the higher humanities of life.

Our congratulations go to all the agencies that hastened in any way the consummation of this benefaction.

LATER

Since the foregoing editorial was written, another concrete example of good will and fellowship has come to light. Earlier in the relief movement, a member from the west coast was forced through adverse circumstances to accept aid from the relief fund. This was granted whole-heartedly, as in other cases of a similar character. But adversity is not always permanent, thanks be, and the other day the chairman of the Relief Commission received the following letter:

May 23, 1938

Dr. E. E. Graham
Secretary to Relief Commission
58 East Washington Street
Chicago, Illinois

Dear Dr. Graham:

I am now able to return the financial aid which your committee so generously voted to assist me during my illness in the summer months of 1934.

The amount of the loan $150 plus interest at 6 per cent for four years $39.37, totals $189.37. My check is attached hereto for this amount.

May I take this opportunity to express to you and your committee my gratitude and appreciation for this kindness?

Confidentially and sincerely yours,

_____

P. S. A duplicate letter and check is being mailed also to_____of the _____State Dental Association.

There is something so fine and wholesome in this letter, and in the act which prompted it, that in itself it is ample justification for the claim that the relief movement was founded in equity and justice, and that it has been carried out with vision and judgment.

That our members are more and more appreciative of its good intent and that the beneficiaries are equally responsive in their attitude is indicated by the reception of this letter. The whole transaction savors of the finest and most salutary sentiment of our common humanity, and the good that must result will add one more link to the chain that binds the membership together.

THE PAN-AMERICAN MEDICAL CRUISE-CONGRESS

In these days of economic stress, when the first law of Nature—self-preservation—is uppermost in the minds of not only individuals, but of groups, communities, professions, nations and races, we are very apt to concentrate upon the problems with which we are immediately concerned and thus develop the conviction that our own little world contains about all that is worth while. It is more and more being borne in upon us that under this stress we have been so occupied with our own affairs in working out the many problems of our profession that we have given less time and thought than we should have to consideration of what our co-workers in other parts of the world are accomplishing.

The inevitable result of such mental trends is a provincialism which underestimates the value of broad international relationships and encourages the smug, complacent mental attitude that fosters the belief that our particular concept is the only one worth while.

Some of us have in a measure overcome this narrow-minded attitude so far as to have developed a national consciousness; a few have acquired an international consciousness, and still rarer is the individual who has eliminated the last traces of provincialism by developing a world consciousness—the cosmopolitan spirit that to him makes "the whole world kin."

One who is so overcome by the type of provincialism referred to as to fail to fully appreciate the value of professional internationalism needs but to reflect upon the benefits derived by the individual and the profession from organized dentistry as it has evolved in our own country. And to reason by analogy, if benefits are to be derived from intensive community and national cooperative effort, similar and proportionate benefits must derive from the international application of the same principles.

That grand old apostle of international confraternity—Charles Godon, of Paris, France—has taught us the many beneficences to be derived from international cooperative effort, particularly in preserving professional autonomy, and now comes the opportunity to expand the principle of international confraternity to include a section of the world that is becoming more and more a factor in professional advancement from the international point of view—the Central and South American countries.

We are pleased to publish elsewhere in this issue a most interesting impressionistic account of a momentous effort in the direction of culti-

vating closer social and professional relations of the medical and dental professions in the South American countries, by Dr. Alfred Walker of New York, the President of the Dental Section of the Cruise-Congress of the Pan-American Medical Association, and one who has been active in promoting the movement toward Pan-American and international fraternalism. Dr. Walker's impressions of the Congress, gained from the advantageous point of view of one of its directors, portray in most attractive style and emphasize in most convincing manner the desirability of continuing efforts toward the development of Pan-American professional relationships. And the Cruise-Congress under discussion furnishes a splendid example of a most agreeable and promising manner of cultivating these relationships.

The desirability of closer professional relationships in the community, the nation and the world is peculiarly impressed upon us by the changing social and political views throughout the world that are directing a new conception of the relation of the health professions to the social body. And we are convinced that unanimity of thought and action throughout the world on professional health matters will be urgently necessary if we are to maintain and preserve the wholesome conception of the health services which has been handed down to us as a sacred heritage from almost the very beginnings of the enlightenment of civilization.

Coincidentally but unrelated to the Pan-American Cruise-Congress, except objectively, there has just been held a Medico-Dental Congress in Mexico, which represents the fruition of a similar effort on the part of the dentists of Southern California in cooperation with the medical and dental professions of Mexico toward closer professional relationship. And the professional confraternity and amity resulting from this first effort have been most encouraging to all who participated in the affair.

The international professional and social benefits to be derived from such relationships have been made so evident that plans are already under way for the next Cruise-Congress of the Pan-American Medical Association, to be held at Buenos Aires in the summer of 1940.

We earnestly commend to the serious consideration of our readers the desirability of participating in this next medico-dental Cruise-Congress. From every point of view it promises to yield an ample return in health, an enlarged sociological appreciation and increased professional inspiration.

L. P. A.

OBITUARIES

ALBERT R. ROSS, D.D.S.

(1876-1938)

ALBERT R. Ross was born at Lafayette, Ind., February 26, 1876, the son of Alexander and Mary (Johnson) Ross. He received his early education in the public schools of Lafayette and later attended Purdue University, receiving the B.S. degree in 1897 and the M.S. degree in 1898. After a brief Government Service in Washington, D. C., he entered the Pennsylvania Dental College, receiving the D.D.S. degree in 1903.

Returning to Lafayette, he at once engaged in the service of his community, not only in the capacity of his chosen profession, but also in many other capacities as the years unfolded. He was most generous with his unusual talents and his time, in unselfish devotion to his fellowmen. His friends were legion. Few there are whose lives are enriched by so many enduring contacts. He became an active member and, in most instances, was an officer in the Masonic bodies from the Blue Lodge through the Council and the Commandry, the Consistory and the Shrine; the Oddfellows, the Redmen and the Elks.

Even in his college days, he was trained for leadership, and he became the head of the Purdue Alumni Association and Grandmaster of the Psi Omega Dental Fraternity.

His civic enterprise was manifested in his succession to leadership in the Lincoln Club, the Young Men's Christian Association and the Young Men's Business Club, and his activities as first president of the Lafayette Community Chest for several years, general chairman of the Lafayette Centennial in 1925 and member of the Kiwanis Club and Interclub Council of Civic Clubs, culminating in his election by his fellow townsmen as their mayor for 1926-1929.

In professional organization activities, few dentists have had such a record of unceasing service. He filled all posts in his local dental society and in his component group. He joined the Indiana State Dental Association in 1905 and his ability was early recognized, for he won every laurel within the power of the Association to bestow.

Activity in diverse committee assignments, which were administered with keen insight and remarkable organization ability, brought him to the secretaryship in 1915, a position which he occupied for five years. At the conclusion of his service as secretary, the appreciation of his distinguished service was manifested by the membership in its presentation to him of a diamond ring, which he always wore thereafter. He was again serving in the same capacity for the fourth year at his demise.

Dr. Ross served as president of the Indiana State Dental Association in 1921. He was repeatedly elected to represent the association in the House of Delegates of the American Dental Association, where again his wise counsel was sought in many capacities. He was elected to represent Ohio and Indiana on the American Dental Association Board of Trustees and, in this post, he was serving his second three-year term at the time of his death. He was elected to membership in the dental honorary fraternity Omicron Kappa Upsilon. He was also a fellow of the American College of Dentists.

Through a third of a century, it has

been our pleasure to work shoulder to shoulder with Albert Ross. Never have we known him to express an unkind word against any man. He often differed on concept of principles involved, but he never resorted to personalities.

His many contacts with many men gave him a deep understanding of human nature. The self-reliance generated in his youth, plus his inbred integrity, fortified the man in man's estate.

Possessed of an almost uncanny power to anticipate the reaction among men, he could plan a course of action that laughed at opposition—and brought forth success. Unselfishly and without thought of personal aggrandizement, he lent his influence to any cause that promised progress for his profession. His career constituted one of those rare exceptions to the old adage, that "a prophet is not without honor save in his own country."

ALBERT R. ROSS, D.D.S.
(1876-1938)

Our friend and colleague is dead, yet

he shall live while memory lingers on; his voice is stilled, yet his wise words prevail among us. He is absent, yet he is ever present. His labors cease, yet his work goes on from designs that he has left upon the trestle board.

His signally honorable record was terminated suddenly by death, May 13, 1938.

ROBERT R. GILLIS.

DR. GEORGES VILLAIN, Paris, France
(1881-1938)

Chirurgien-Dentiste, Officier de la Légion d'Honneur, Chevalier de l'Ordre Leopold de Belgique, Directeur de l'École Dentaire de Paris, D.D.S. (Univ. Pa.).

ON Tuesday, April 26, Georges Villain, together with his two sons, Jean and Claude, his daughter-in-law and his sister-in-law, Madame Coquille, was laid to rest in the cemetery of Mont Parnasse. The interment was preceded by a Solemn Mass at Notre Dame de Lorette, his parish church. A large congregation, including friends and dental representatives from many foreign countries, was present at the ceremonies.

The occasion of Dr. Villain's death in the plenitude of his health and energy was a peculiarly tragic one. On the evening of Friday, April 22, Dr. Jean Villain, the eldest son, was driving the family party of six back from Fontainbleau to Paris and crashed into the back of an automobile truck traveling in the same direction. Five of the party were killed instantly; Madame Villain escaped with head injuries and is expected to recover. We extend to Madame Villain our deepest sympathy in the tragic blow which fate has dealt her.

Georges Villain was born in Paris in 1881, where he graduated as Chirurgien Dentiste de la Faculte de Medicine de Paris in 1903. For two years he attended school in High Wycombe (England), where he acquired that complete command of the English language which later was to prove of immense value in his work for the Fédération Dentaire Internationale. Later he entered the Dental School of the University of Pennsylvania, and received the D.D.S. degree in 1906. On returning to Paris he joined the staff of l'Ecole Dentaire, holding successively the appointments of Professor of Prosthetics and Orthodontics, becoming Vice-Principal in 1920 and Principal in 1926, a position which he held to the time of his death. He was president of various French dental organizations and a member of the Legion of Honor. He received many other decorations at home and abroad and was an honorary member of many foreign dental associations. In short, Georges Villain was a most distinguished, a most beloved and a most important figure in French dentistry.

It is, however, by his work in the Fédération Dentaire Internationale that Georges Villain is known to the dentists of the world. As a student he was present at the historic Congress of 1900, when the Fédération Dentaire Internationale was founded, and the principle of international scientific solidarity, conceived by President Godon and embodied in the Fédération Dentaire Internationale, was to prove an inspiration which lasted through the whole of his life. In international dentistry his life falls into two periods, separated by the War, when he organized and directed a most efficient department for the treatment of jaw and facial injuries at l'Ecole Dentaire de Paris.

During the first or formative period, 1900-1914, Villain was fortunate in his association with eminent men of mature mind and international repute. Although a true son of France, his war experience strengthened his conviction of the futility of racial animosity and he took an active part in organizing the Fédération Dentaire Internationale meeting at The Hague in 1921, the Fédération Dentaire Internationale being one of the earliest international societies to resume activities after

the war. In the second period, or period of maturity, 1920-38, Villain successively filled the offices of Assistant Secretary, General Secretary, President and President of Honor. He was President of the 1931 Congress at Paris, and at the time of his death was perhaps the most widely known personality in the dental world.

Although of spare figure, his active mind directed an almost superhuman physical energy which enabled him to carry on a large, successful, busy private practice in addition to his outside interests. The charming smile, the warmth and sincerity of his greeting, will be remembered by all who met him. A devoted husband and parent, he rarely

GEORGES VILLAIN
(1881-1938)

attended a meeting without bringing his entire family with him.

Those who have lost a beloved friend and colleague offer heartfelt sympathy to his French colleagues, to his brother and relations and, above all, to Madame Villain.

ARTHUR R. McDOWELL, D.D.S.

(1890-1938)

ARTHUR R. McDOWELL, dean of the College of Physicians and Surgeons, a School of Dentistry, San Francisco, Calif., was born in Yuba County, California, January 8, 1890. His father, James McDowell, was born in Maine, November 19, 1841, and his great-grandfather, John McDowell came from Scotland prior to or about the time of the Revolutionary War. James McDowell came to California May 7, 1862.

Dr. McDowell received his education in the public schools of Yuba County and in the Wilkins Normal School at Marysville. In 1914, he entered the dental college of which he later became the dean, graduating in 1917. America being then at war, he accepted a commission as first lieutenant in the Dental Section of the Officers Reserve Corps of the United States Army, but, while waiting for call to active duty, he engaged in teaching in the College of Physicians and Surgeons. For two years, until 1919, he was a demonstrator in operative dentistry.

In 1920, he was made junior dean of the faculty, and September 1, 1923, he was elected dean. During these years, there were many extensive changes and developments in dental education, and Dr. McDowell, with his associates, succeeded in transforming this school into one with a Class "A" rating.

Dr. McDowell served his profession extensively, being a member of the American Dental Association, with its components, the American College of Dentists, the Omega Kappa Upsilon honor society, the Psi Omega Fraternity and the American Association of Dental Schools, which he served as president in 1935. His contribution to dental literature through papers presented and discussion of papers by others is extensive.

He was a life member of Alta Vista Lodge, F. and A. M., and other councils with the lodge, also of the Shrine, being a member of Islam Temple.

Dr. McDowell was married in San Francisco, November 26, 1922, to Miss Helen B. Kramer, of Eureka, Calif., who with a son, Alan Rae McDowell, and a daughter, Coleen Dunning McDowell, survives.

DEATH OF DR. F. R. HENSHAW

IT is with much sadness that we announce the death of Dr. Frederic R. Henshaw, Indianapolis, Ind., which occurred on May 27. An obituary notice of Dr. Henshaw will appear in a later issue of THE JOURNAL.

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

Anesthetics—Local*

Procaine Hydrochloride Solution 2% with Epinephrine 1:50,000-Rorer: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; epinephrine, 0.00002 gm.; sodium bisulfite, 0.0019 gm.; chlorobutanol (a derivative of chloroform), not in excess of 0.005 gm.; sodium chloride, 0.003 gm., and redistilled water, q.s.

Manufactured by William H. Rorer, Inc., Philadelphia, Pa. No U. S. patent. U. S. trademark No. 354460.

Procaine Hydrochloride Solution 2% with Epinephrine 1:50,000-Rorer in Injection Cartridges (Hypotubes), 2.5 cc.

Procaine Hydrochloride Solution 2% with Epinephrine 1:25,000-Rorer: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; epinephrine, 0.00004 gm.; sodium bisulfite, 0.0019 gm.; chlorobutanol (a derivative of chloroform) not in excess of 0.005 gm.; sodium chloride, 0.003 gm., and redistilled water, q.s.

Manufactured by William H. Rorer, Inc., Philadelphia, Pa. No U. S. patent. U. S. trademark No. 354460.

Procaine Hydrochloride Solution 2% with Epinephrine 1:25,000-Rorer in Injection Cartridges (Hypotubes), 2.5 cc.

Procaine Solution 2% with Epinephrine 1:25,000-Procaine Co. Brand: Each cubic centimeter is said to contain procaine hydrochloride 0.02 gm.; epinephrine as sulfite, 0.00004 gm.; sodium chloride, 0.007 gm.; potassium chloride, 0.0003 gm.; calcium chloride, 0.00025 gm.; sodium bisulfite, 0.0022 gm., and distilled water, q.s.

Manufactured by the Procaine Co., Inc., New York City. No U. S. patent or trademark.

Procaine Solution 2% with Epinephrine 1:25,000-Procaine Co. Brand in Cartridges, approximately 2.5 cc.

Procaine Solution 2% with Epinephrine 1:50,000-Procaine Co. Brand: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; epinephrine as sulfite, 0.00002 gm.; sodium chloride, 0.007 gm.; calcium chloride, 0.00025 gm.; potassium chloride, 0.0003 gm.; sodium bisulfite, 0.0022 gm., and distilled water, q.s.

Manufactured by the Procaine Co., Inc., New York City. No U. S. patent or trademark.

Procaine Solution 2% with Epinephrine 1:50,000-Procaine Co. Brand in Cartridges, approximately 2.5 cc.

Procaine 2% Solution with Epinephrine 1:25,000-Endosol Brand: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; epinephrine, 0.00004 gm.; sodium bisulfite, 0.0015 gm.; sodium chloride, 0.00375 gm.; potassium chloride, 0.0001 gm., and distilled water q.s. to make 1.0 cc.

Manufactured by Endosol Laboratories, New York City. No U. S. patent or trademark.

Procaine 2% Solution with Epinephrine 1:25,000-Endosol Brand in Cartridges, approximately 2 cc.

Procaine 2% Solution with Epinephrine 1:50,000-Endosol Brand: Each cubic centimeter is said to contain

*A.D.R. 1937, p. 36.

procaine hydrochloride, 0.02 gm.; epinephrine, 0.00002 gm.; sodium bisulfite, 0.0015 gm.; sodium chloride, 0.00375 gm.; potassium chloride, 0.0001 gm., and distilled water q.s. to make 1.0 cc.

Manufactured by Endosol Laboratories, New York City. No U. S. patent or trademark.

Procaine 2% Solution with Epinephrine 1:50,000-Endosol Brand in Cartridges, approximately 2 cc.

Procaine Hydrochloride, 2%, with Epinephrine 1:60,000-Abbott: Each cubic centimeter is said to contain procaine hydrochloride, U.S.P., 0.02 gm.; epinephrine, 0.000016 gm.; sodium bisulfite, 0.001 gm.; potassium sulfate, 0.009 gm., and chemically pure water to make an isotonic solution.

Manufactured by Abbott Laboratories, North Chicago, Ill. No U. S. patent or trademark.

Procaine Hydrochloride, 2%, with Epinephrine 1:60,000-Abbott in Cartridges, approximately 2 cc.

Procaine Hydrochloride, 2%, with Epinephrine 1:30,000-Abbott: Each cubic centimeter is said to contain procaine hydrochloride, U.S.P., 0.02 gm.; epinephrine, 0.000033 gm.; sodium bisulfite, 0.001 gm.; potassium sulfate, 0.009 gm., and chemically pure water to make an isotonic solution.

Manufactured by Abbott Laboratories, North Chicago, Ill. No U. S. patent or trademark.

Procaine Hydrochloride 2%, with Epinephrine 1:30,000-Abbott, in Cartridges, approximately 2 cc.

Dentifrices*

T M C Tooth Paste: Composition: See Sheffield Tooth Paste (A.D.R. 1937, page 110).

Manufactured by the Sheffield Company, New London, Conn. Distributed by the May Department Stores Company, New York City. No U. S. patent or trademark.

Opium Derivatives†

Apomorphine Hydrochloride, U.S.P.—Apomorphinae Hydrochloridum (Apomorph. Hydrochlor.)—The hydrochloride of an alkaloid prepared from morphine.

Apomorphine Hydrochloride-Merck: A brand of apomorphine hydrochloride, U.S.P.

Manufactured by Merck & Co., Inc., Rahway, N. J. No U. S. patent or trademark.

Magnesium Compounds‡

Magnesium Oxide, U.S.P. (See A.D.R. 1937, p. 152.)

Magnesium Oxide—Merck, Light: A brand of magnesium oxide, U.S.P.

Manufactured by Merck & Co., Inc., Rahway, N. J. No U. S. patent or trademark.

Heavy Magnesium Oxide, U.S.P. (See A.D.R. 1937, p. 152.)

Magnesium Oxide—Merck, Heavy: A brand of heavy magnesium oxide, U.S.P.

Manufactured by Merck & Co., Inc., Rahway, N. J. No U. S. patent or trademark.

Sodium Phosphate, U.S.P.—Sodii Phosphas (Sod. Phos.) $Na_2HPO_4.7H_2O$.

Sodium Phosphate-Merck: A brand of sodium phosphate, U.S.P.

Manufactured by Merck & Co., Inc., Rahway, N. J. No U. S. patent or trademark.

Formaldehyde Preparations and Compounds Which Liberate Formaldehyde§

Solution of Formaldehyde, U.S.P. (See A.D.R. 1937, p. 137.)

*A.D.R. 1937, p. 105.
†A.D.R. 1937, p. 163.
‡A.D.R. 1937, p. 152.
§A.D.R. 1937, p. 136.

Formaldehyde-Merck: A brand of solution of formaldehyde, U.S.P.
Manufactured by Merck & Co., Inc., Rahway, N. J. No U. S. patent or trademark.

Reagent Formaldehyde-Merck, Neutral (36-38% HCHO).
Manufactured by Merck & Co., Inc., Rahway, N. J. No U. S. patent or trademark.

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information on the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Preventing Disintegration of Photographic Fixing Solution—Roentgenographic developing solutions oxidize very rapidly in developing tanks. When an extra amount of solution is made up and stored in an amber bottle and kept in a dark cool place, no air chamber should be present between the stopper and the solution. Even this small amount of air rapidly disintegrates the solution. Hence a tank, irrespective of the tight fitting lid, allows a maximum amount of oxidation. To prevent this and keep the exposed surface of the solution in the tank at a minimum, a pattern is cut from a stiff piece of paper the exact size of the tank at solution level so that paper contacts the tank wall at all points. A supply of "covers" of ordinary wax paper are cut from this pattern and one is laid on the solution. This paper will float on the surface and exclude the air. A new cover should be used after each developing. A dilute acetic acid bath, 1 teaspoonful to 1 pint water, will act as a fixer and hardener before the film is placed in the regular fixing solution. The film is washed in clear water before being placed in the fixer. This bath aids in preventing overdevelopment and scuffing of the emulsion. To promote rapid drying of films, the water tears that form at the bottom of the films when they have stood a few moments are removed with a synthetic sponge in the following manner: The sponge is filled with water and the excess is squeezed out, then the water tear is touched with a corner of the sponge, when it will be absorbed instantly. The sponge must be damp to prevent scratching the emulsion.—*F. J. Svoboda and Esther E. Svoboda, Cozad, Nebr.*

Variables in Dental Practice—Adverse variables are combated through the use of controllable variables. Nearly every operation in dentistry is affected by variables, which must be considered, controlled or eliminated, to attain the measure of success desired. Some of these variables are easily nullified or turned to advantage at will and with little expense; others are major obstacles to our success with a given method or material. These variables are continually appearing in such operations as making roentgenograms, building dentures and placing

amalgam fillings, gold inlays and silicate fillings. Each operation has a rather long list of variables which must be considered.

Some of these detrimental variables may be managed by a fixed rule or mechanical procedure. However, the majority of variables are most easily managed by introducing procedures which are themselves variables easily under control and not expensive as to time and money.

As a concrete illustration of this, let us consider the variables surrounding the insertion of a silicate filling, which, for the sake of argument, has been furnished to us in as nearly perfect state as is humanly possible. Batches are bound to vary. Nothing is an absolute fixture. The bottles are opened and the contents used in various parts of the world, with a relative humidity varying from hour to hour, day to day and season to season, as much as 90 degrees. There is but one point in the whole range where the fluid of any make is stable or balanced. Higher than that point, the fluid becomes more dilute; lower, it becomes more dense, all of which affects consistency and setting time. Exposed powder takes up moisture.

Other variables are room temperature, mixing slab temperature, mixing time, powder-liquid ratio, mortarization and percentage of voids, as well as the position of voids in the completed filling. There is a variation, minute perhaps, in every silicate filling mixed, which must be combated or controlled by other variables under control for that specific mix, or occasion. A fixed mechanical procedure will control some variables some of the time, but no variables all of the time. —*W. Clyde Davis, Lincoln, Nebr.*

Treatment of Hydrocolloid Impression to Insure Hard Surface of Cast—The impression is thoroughly washed; the excess water blown off, and a saturated solution of sodium or potassium sulfate is poured over it, after which the water is evaporated from the surface with an air blast. There will now be a concentration of sulfate at the surface of the impression, which will have a hardening effect on plaster or hydrocal when the cast is poured.—*Alfred T. King, Chicago, Ill.*

Natural Tooth Appearance in Dentures—Following is a description of a method that has been found satisfactory for improving the appearance of teeth in dentures and bridgework. When proper molds, shades and a setup simulating the characteristics of the patient are present and yet there seems to be a false reflection due to opacity, careful study has shown us that this reflection results from a surface too flat and of the same color, but that it can be broken up, so as not to catch eye so readily, by grinding of these flat surfaces.

In no sense do we mean to convey the idea that the entire surfaces in view should be ground. In certain cases, removing the glaze from the incisal third of labial surfaces, not always including all of the anterior teeth, and extending the grinding into the labial third in the labial sulci only, or between the sulci, often improves the case considerably. Often, removing the glaze carefully, somewhat following the horizontal laminations, is of great value in breaking up the concentrated reflection. Each case is to be studied before work is begun. A generous labial surface spot grinding is helpful, the size of each spot being dependent on the case. Interproximal surfaces are not to be entirely ignored.

When spot grinding is complete, and this is done with a fine wet stone, the surface is polished well with a rubber and grit cups and wheels. This polish does not replace the glaze formerly on the surface; hence, the reflection is subdued in these areas. The light is also thrown in various directions. It is also well to note that even a perfectly formed

central incisor if dried carefully with cotton by blotting instead of rubbing, and further dried with air blasts, does not present so high a polish as does glazed porcelain.

Highly polished surfaces reflect light and color in fullest concentration, making the object more noticeable. Dull surfaces absorb the light. Thus, when a porcelain tooth is ground as herein described, there is absorption of light by the tooth as well as a reflection, giving the tooth a more translucent effect. The texture of the ground surface is determined only under clean wet conditions, preferably in the mouth.—*Esther Svoboda and F. J. Svoboda, Cozad, Nebr.*

An Amalgam Aid—Proper contact for proximal amalgam fillings can be more readily obtained in the following manner: The matrix is selected and put in position on the tooth to be filled, when cavity preparation is completed. With a small sharp cutting instrument, the exact point for contact is indented on the cavity side of the matrix. The matrix is removed from the tooth and matrix holder and, with the side scratched by the instrument up, is placed on a pad of paper that contains more than twenty sheets of paper. This amount of paper is needed because a noticeably compressible base is required. With a medium-sized egg burnisher, the desired contact point of the matrix is heavily burnished into the paper pad. This point is circumscribed several times, the operator each time burnishing farther from the central point and decreasing the pressure. This extends the matrix for a more anatomic proximal contour and contact point. To obtain the proper contour for the proximobuccal angle, the matrix is burnished vertically while still on the pad, from a point 1 mm. above the gingival seat at the exact point where the proximobuccal angle begins and with a gradual increase of the pressure through to the occlusal surface of the band just buccally to the contact indentation already made.

If none of the gingival portions of the matrix band is burnished, this portion will hug tightly the gingival portion of the tooth when it is in place and tightened about the tooth. In fact, the matrix holds better gingivally when burnished than when put to place flat. Amalgam is packed heavily with a small plugger point against and into the contact point. Time is allowed for setting and the matrix is withdrawn linguoclusally. —*F. J. Svoboda and Esther E. Svoboda, Cozad, Nebr.*

Retention in Short-Crowned Teeth for Akers Cases—If an Akers appliance is desired on either side and one of the teeth selected to be clasped is too short and will therefore allow the appliance to continuously slip off and annoy the patient, a groove is cut along the buccal surface of the short-crowned tooth, following the curvature of the gingiva. The groove should be cut deep enough that the clasp may fit securely into position and hold the case very firm. Owing to the undercut of the groove, a split-tray plaster impression technic is used or the impression is taken with an elastic impression material such as dentocoll or surginoll. Incidentally, in making this type of appliance, the bridge should be constructed of a precious or semiprecious metal so that the clasps will not be too rigid. As the case must be put in position and removed from an undercut, the clasps should have a tendency to give. Rigidity in these cases is not desirable.—*Herbert Orman, Baltimore, Md.*

ASSOCIATION ACTIVITIES

RESEARCH COMMISSION

SELECTING DENTAL MATERIALS

By P. C. Lowery,* D.D.S., Detroit, Mich.

THE Research Commission of the American Dental Association wishes to further acquaint the members of the profession with the developments of the work of the Association fellowship at the National Bureau of Standards. This year, the cooperative research program on dental materials is costing each member of the American Dental Association thirty-one cents.

Information concerning this cooperative work is presented through the pages of THE JOURNAL under the heading "Association Activities," by members of the Research Commission, fellows at the Bureau and members of the cooperative groups appearing before the various state dental societies and especially before the Research Section of the Annual Session of the American Dental Association.

We are convinced that many dentists are becoming sufficiently acquainted and impressed with the cooperative work on dental materials at the Bureau to apply the results effectively. However, further discussion is believed advisable.

It is my privilege to explain to the members of the American Dental Association the activities of the Research Commission and to show how effectively the collective thirty-one cents have been converted into a practical knowledge of dental materials. Today, dental material problems are so complex and numerous that adequate research on them is becoming a problem. We use metals and their alloys; organic materials, such as waxes, impression compounds, rubbers and synthetic resins, and ceramic materials, such as gypsum, cements and porcelains. It is obvious that many men with specialized technical training are needed to investigate scientifically this wide variety of materials used in dentistry.

It is, therefore, most fortunate that the American Dental Association, with Federal support, has been able to assume and maintain the fellowship for research on dental materials at the National Bureau of Standards, where there are specialists in practically every field of physics and chemistry. Where could one find a more suitable laboratory in which to conduct exact investigations on dental materials?

I shall not discuss, at this time, our connection with the Bureau or the functioning and personnel of the two cooperating groups other than to say that it is most satisfactory and cordial.

So far, the Commission has developed standards for the following materials: amalgams, inlay investments, impression compounds, inlay casting waxes, inlay casting golds, wrought gold wires, dental mercuries, cementing media (zinc oxyphosphate cements) and silicate cements. These standards are now serving as yard-

*Chairman, Research Commission, American Dental Association.

sticks by which the suitability of the materials can be judged.

A revision of casting gold and wrought gold wire specifications is in progress and specifications for denture base materials will soon be completed. The colloidal impression materials are also being studied.

Thus, the main object of our work at the Bureau is to make available to the profession standards for dental materials and technics most suited to their specific purposes. Already, decided improvement in the quality of these materials is evident; already, the methods of handling them have been improved.

Now, why is the dental profession financing and supporting this work? There is only one answer: The dentist prefers to use only the best materials obtainable and he desires to use them in the most intelligent manner. In other words, you are giving the best professional service that you can render and are actively supporting research which is aiding you in rendering a constantly improving service.

These findings have raised the standards of dentistry and have increased the life span of operative restorations, particularly of the gold inlay and amalgam. This is a distinct contribution to dentistry and a decided benefit to the public.

Thus far, we have sought to present here only a general estimate of the labors of the Research Commission and its aims. We now wish to acquaint the dentist more intimately, without boresome detail, with the steps pursued by the research workers before a product is passed on to the profession with the assurance that it can be used with safety and confidence; i.e., it is a "certified product."

This leads to a brief consideration of what has proved to be a vital matter. What do we understand by a "certified product"? A "guaranteed product"? In general parlance, the words "certified" and "guaranteed" are practically interchangeable; but, in the matter before us, certified dental products and guaranteed dental products may be and often are very different.

Many manufacturers of dental materials make statements on their packages or containers to the effect that their products conform to all Federal and American Dental Association specifications. Or they may include the still broader statement that their product is guaranteed to comply with an American Dental Association specification. A dentist not fully informed may accept this as a statement of fact, when in reality the merchandise may not actually comply with the statement. A manufacturer who goes no farther than to simply guarantee his product could honestly or dishonestly continue to manufacture or sell it until such time as some one made a scientific investigation of the product and found a misstatement of facts in the guarantee. Only then could the advertising be stopped, through the Federal Trade Commission.

There are manufacturers of dental materials today who advertise that their products meet the requirements of the American Dental Association specifications, and even such statements as "Guaranteed to comply with American Dental Association Tentative Specification No. 9" are published. A dentist has no way of knowing for a certainty that such products do or do not comply with American Dental Association specifications unless the name of the product under question appears on the Commission's certified list. If the Commission were to examine independently a product purporting to comply and find that it did so, the name of the product would still not be published in the certified list until the manufacturer made a request to have the material certified. So much for a guaranteed product. Now, let us see what "certified product" means.

"CERTIFICATION"

When a manufacturer makes application to the Research Commission of the

American Dental Association for certification of a product, forms are sent to him on which he is requested to supply the Research Commission with definite and accurate data covering every requirement of the specification. In addition, he is required to supply the Commission with the sample package or container in which respective products are marketed and with information as to whether the physical properties were determined in the manufacturer's plant or elsewhere, with method and manner of test. Specimens of the labels, guarantees and instructions for use that are furnished with the product must also be supplied. In other words, all pertinent data are submitted in proof of the physical properties of the material. At the same time, the manufacturer guarantees to the Commission to both produce and maintain consistently products that possess the qualities of a specification material. Those materials that are certified to the Commission by the manufacturer are from time to time procured by the Commission's agents through dental dealers in various parts of the United States. At the time of procurement, the manufacturer does not know that the materials are for test examination. All certified materials that satisfactorily pass the tests at the Bureau are published in the certified list. If they fail to comply, they do not appear on the list. If the material is already on the list, it is deleted for at least one publication, or until such time as the manufacturer can correct the defect and recertify his product to the Commission. In other words, a white list rather than a black list is published.

Because we are steadily increasing the number of specifications and since the manufacturers are cooperating with the Commission's program, the work of checking materials has grown to such an extent that it requires the full time of two trained fellows and part time of other members of the Bureau staff.

Many members of the profession believe that, from a safety standpoint, they should purchase materials that are guaranteed to comply with specifications, but few of us are familiar with the process of or sense the importance of certification.

If a dentist tells us that he is buying a guaranteed product and we know that it is not on the certified list of such products, we should suggest that he ask the manufacturer why he has never certified the product in view of the fact that it costs a manufacturer nothing, and in fact is nothing more than a check-up on his product by the Research Commission.

Remember this: The manufacturer does not pay the Research Commission one cent for the inclusion of his product in the list. There is no fee. Big or little, manufacturers are all treated alike. We, the profession, are bearing the expense of this testing program, which is beneficial to us as well as to our patients.

Why are we supporting this work? Because we desire to use the most satisfactory material, and because we wish to know whether the manufacturer's guarantee is valid. It is the difference between (1) accepting the manufacturer's statements and (2) receiving the facts from those whose work we, as a profession, are supporting in order that the actual facts may be available. Therefore, the safe way for a dentist to purchase dental material is to choose one that the manufacturer has asked to have certified and that the Commission has examined and found to be satisfactory.

Now that we have differentiated clearly between a certified and a guaranteed product, let us briefly list the steps taken in determining what an American Dental Association Specification shall be.

1. A review and study of the literature on the material under observation is made.

2. Research on and testing of the material at the Bureau are carried out.

3. Information is secured from other testing laboratories.

4. Conferences are held with the various manufacturers of the material.

5. Suggestions are asked from dental schools and dentists, including especially selected cooperative groups of dentists.

6. A tentative specification is sent to
   (a) The Research Commission.
   (b) Dental schools.
   (c) Manufacturers.
   (d) Known authorities on the material.

7. Comments are studied and discussed with manufacturers and other interested parties.

8. A proposed specification is forwarded to the Research Commission. (Here the work of the Bureau ceases.)

9. The specification is sent to the Research Commission, the Board of Trustees and the House of Delegates, for adoption or rejection.

If adopted, the specification becomes effective one year later. A specification is always subject to revision. As the various materials are improved, the specification should be "stepped up" to include only the best.

Let us now consider two of the more recent activities at the Bureau; namely, investigation of the silicate cements and the denture base materials.

The cooperative groups at the Bureau made a three-year intensive study of the silicate cements, which included studies on the composition of both powders and liquids, including the arsenic content; the consistency of mix; the time of setting under different atmospheric conditions; the crushing strength after storing in different solutions, such as distilled water, natural saliva and mineral oil; the influence of the temperature and humidity of the mixing environment on the physical properties of the cements; the staining with dyes; the effects of prematurely exposing the silicate cement to water or saliva; the temperature rise on setting; the acidity and alkalinity of the powders, liquids and mixed cements; solubility and disintegration; the variance of physical properties among batches and colors of the same cement; the dimensional change in setting, and the effect of the humidity of the air on the physical properties of the cement.

The matter of degree of opacity of the silicate cements required much thought. Through a long series of complicated research, requiring the creation of special testing apparatus, it was determined that a tentative required standard for opacity of silicate cements should not be less than 35 or more than 55 per cent.

The subject of the arsenic content was another consideration. Tentatively, the arsenic content permissible was set at 1:50,000; which is the minimum content possible in a commercial product. We have no definite proof that arsenic in such small quantities has any detrimental effect on the pulp. Zinc phosphate cements containing more than this amount have been used for years. However, the question opens a field in both chemical and biologic research which dentistry must invade at an early date.

The Commission had great difficulty in arriving at a decision as to the arsenic content. It was only after consulting many chemists and interested dentists that the present ratio was set up.

A cooperative group of nearly 200 dentists from all parts of the United States are now working on experiments and tests on the silicate cements. A tentative specification No. 9 adopted by the Board of Trustees and House of Delegates in July 1937 will become effective in July of this year.

The following excerpt from a recent letter received from Dr. Lyman J. Briggs, director of the National Bureau of Standards, expresses the friendly and appreciative spirit that exists between the research group and the manufacturers of dental materials:

The silicate cement report is undoubtedly the outstanding contribution during the year. The whole-hearted cooperation and assistance on technical and advisory matters by the leading manufacturers of these cements has been most gratifying to the Bureau. This friendly relation also extends to the manufacturers of other dental materials. Few weeks passed without a conference with one or more manufacturer's representatives seeking or offering suggestions to advance the cooperative program. These conferences invariably close with an invitation to visit the laboratory or plant. I fear our dental workers are not taking advantage of a sufficient number of these courteous invitations. Perhaps this can be remedied in 1938.

Since the publication of the silicate cement report in the January issue of THE JOURNAL, the Research Commission has received several complaints about their policy of not using trade brand names in the preliminary report on silicate cements. In the foreword of the silicate report, the Executive Board of the Research Commission explained why it was not printing the trade names in that report. To further elucidate the Commission's policy, I again point out that the data in the silicate cement report were based upon one batch, or at most a very few batches, of a manufacturer's output. Investigation revealed that there were often great differences in the quality and physical behavior of different batches of a cement. That it would be folly for the Research Commission to encourage the use of certain brands of cement on data from one batch is evident. The Commission has little assurance that the batches of silicate cement procured for testing are representative of the manufacturer's output. When assurance is definite, we shall use the trade brand names and publish a list of the silicate cements which not only pass the specification tests, but on which also the Research Commission has definite proof that the manufacturer is routinely testing his cement.

The test methods and the specifications which were presented in the silicate cement report are new. The manufacturer has had little opportunity to try them out or to study or evaluate them critically. A year of grace is given the manufacturer to do this, because a specification is not effective until a year after its adoption by the House of Delegates of the American Dental Association. This situation is analogous to one existing today in dentistry. Let us assume that it is a dental technic which we are going to investigate instead of a manufactured product. Let us assume that the Research Commission has established and is supporting a fellowship to investigate the technic which dentists are using to raise the bite. During the investigation on this problem by the fellowship, a new and better technic is developed, one which will make obsolete the technics now commonly in use. The report of findings is being written. The author says that he investigated Dr. A's and Dr. B's technics and found them very bad, and that Dr. C's was even worse—in fact, in the case of Dr. C's technic, there had been developments which caused the patient great inconvenience and suffering. Now a new technic is prescribed. The names of the dentists and their reprehensible procedures are to be published, before the dentists have had an opportunity to study the new technic or to try it. Drs. A, B and C were using the technics which were in common use: if they had been shown a better way, a better method, they would have used it; and so it is with the products of a manufacturer.

As chairman of the Research Commission, I have had dealings with many of the manufacturers, and I have come to the conclusion that most manufacturers will better their product whenever they have the opportunity, just as a dentist will his methods of treatment. All that he asks for is an opportunity to improve his material. The Research Commission believes that he should be given an op-

portunity to improve his material before he is censored, just as the dentist should be given an opportunity to improve the quality of his service before he is condemned. Fair play is the same the world over, and it is not restricted to the profession.

The policy of the Research Commission in the use of trade names is a fair one. As a result of this policy, practically every dental manufacturer of any consequence is cooperating with the Research Commission in its program. Proof of this statement is seen in the list of certified materials on pages 475 to 479 of the March issue of THE JOURNAL.

A specification for the vulcanites will soon be completed and a thorough study of the synthetic substitutes is now being made. If there had been a specification for these materials, the exploitation of the last few years would have been impossible.

I have been talking about thirty-one cents tonight. How much has it cost the dentist to experiment with these synthetic substitutes for rubber? The answer to this question will be a classic example of the enormous waste of time, energy and money of both dentist and patient which is possible on uncorrelated clinical experimentation. As I survey the existing chaos in this field, I am more than ever convinced that, in a great number of instances wherein the clinical tests are in the hands of innumerable persons, with no central control nor correlation, it is difficult, if not impossible, to secure accurate or even fairly reliable service statistics.

A study of variations among batches of vinyl resins and among the batches of phenol-formaldehyde resins shows them to be very different. If the same technic is used for each batch, as of course it should be, greatly different results can be expected. If different technics are used, greater variations will be found. These phases of the problem are being studied at this time.

Data have been obtained on the following properties: tensile strength, elongation or set, impact strength, flexural fatigue, water absorption, softening point, warping, color life, heat transfer, or thermal conductivity, shelf life, composition and solubility.

Vinyl resins are a mixture of vinyl acetate and vinyl chloride molecules. The size of the molecule and the proportional amounts of each size have a relation to the physical properties of the resin. By fractional solubility determinations, the relative amount of each size group can be ascertained. If one batch of vinyl resin has a high proportion of large molecules, *e.g.*, those having a long chain structure, it will, in general, have better physical properties than a batch having large proportions of relatively small molecules, *i.e.*, those having a short chain structure. However, the long chain structure is not very plastic at permissible forming temperatures and the result is a denture with high strain, which may warp or crack. If the forming or pressing temperature is raised, the resin discolors. The short chain structure is somewhat the reverse. Different proportions of short and long chain groups will have different softening temperatures. One pressing technic will not suffice for all combinations which were found. In further explanation of the complexity of vinyl resins, if a blank large enough to construct two full upper dentures were divided in half, one of the halves might have a larger number of large molecules, and the other half a larger number of small molecules. Dentures constructed from such a division of a blank would show entirely different physical properties. Perhaps this fact helps to explain some of the many failures in service of these materials.

The work of the Association fellows at the Bureau is not devoted to a research with the intent to create a material of this type of their own, but rather to do

the "spade" work in determining the properties and assisting the manufacturers of the various materials to improve and standardize their products. This is just what is happening. It happened with amalgams, cements and all of the other products for which we have developed standards.

I must not close this exposition on dental research in the field of selection of dental materials without a plea for its complement in progress, biologic research. In the beginning, I stated that each member of the American Dental Association contributes the sum of thirty-one cents toward physical research. For biologic research, only three cents per member is contributed.

The Research Commission is of the opinion that organized dentistry should again function effectively in biologic dental research. The Commission strongly recommends the establishment at the National Institute of Health (the research division of the U. S. Public Health Service, Washington, D. C.) of a fellowship for the study of dental diseases, the primary object being to investigate dental caries. This will be a promising beginning to such a program. In order that the dental viewpoint may be maintained, we believe that the senior research fellow should have a dental degree. Such a fellowship could be supported by the American Dental Association for approximately ten cents per member. Other fellowships, supported by foundations or individuals, could be added at any time. This would give the Association an official status in the general public health program similar to our present connection with the National Bureau of Standards.

Many unsolved problems in biologic research pertain to dentistry. For example, What causes the death of a dental pulp under silicate cement? Here is a situation that calls for both chemical and biologic dental research. We have an excellent set-up for physical and chemical research. Let us develop an equally commendable group in biologic research. We also have a "no-man's land" between dental and medical biologic research. The non-vital tooth, dental caries, periodontoclasia and temporomandibular disturbances due to deflection of the mandible are common medical and dental problems.

I have attempted to give the members of the profession an insight into the Association's program of research at the National Bureau of Standards. I wished to show that our paramount interest is in seeing that the dentist gets better dental materials, and comes to know better methods of manipulating the materials, which will enable him to render a better health service—the goal of the profession.

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Lowery Building.

AN INVESTIGATION OF FOUR GYPSUM MATERIALS USED TO PREPARE INDIRECT INLAY MODELS*

By George C. Paffenbarger,† D.D.S., and John R. Beall,† B.S., Washington, D. C.

FOREWORD

THE Research Commission of the American Dental Association has received inquiries about a material used in the preparation of models for indirect inlay work. This material is manufactured by the Whip-Mix Corporation of Louisville, Ky., and is marketed under the trade brand name of "Akratex." An excerpt from an advertising folder on this material says: " 'Akratex' is a new material developed specifically to produce hard, smooth models (or dies) for the accurate construction of Inlays and Bridge attachments by the Indirect Method; . . ."

Our research associates at the National Bureau of Standards surmised, from a study of the company's published data on the physical properties and the technic advocated in the advertisements, that "Akratex" was essentially a special plaster of Paris and was probably not a new type of material. The Executive Board of the Research Commission therefore requested that this material be examined. After the investigation was started, the Commission received inquiries about another material of apparently the same type, made by the Detroit Dental Manufacturing Co. and sold under the name "Diolite." The Commission requested that this product also be included in the investigation. Significant physical properties of these materials were compared with those of two currently used rapidly setting artificial stones.

A study of the following report of our research associates shows that the common, currently used artificial stones having a "hydrocal" base and a setting expansion of 0.10 plus or minus 0.05 per cent are satisfactory for indirect inlay models. They are as satisfactory for this purpose as "Akratex" and "Diolite" and are much cheaper. In fact, the retail prices of "Akratex" and "Diolite" were 49 and 3½ times, respectively, that of the artificial stones.

Executive Board,
Research Commission.

MATERIALS INVESTIGATED

The four gypsum materials used in the investigation by the Bureau of Standards are listed in Table 1.

A petrographic examination of the four materials was made by H. Insley of the National Bureau of Standards, who found that the materials consisted essentially of crystals which had the same index of refraction and the same crystal form as a well-known commercial calcined gypsum called "hydrocal" (a special gypsum made by the U. S. Gypsum Co.).

*A report to the Research Commission of the American Dental Association. (Publication authorized by the Executive Board of the Research Commission.)

†Research Associate of the American Dental Association at the National Bureau of Standards.

"Hydrocal" is the basis of almost all of the currently used, rapid-hardening dental artificial stones.

Chemical examination by I. C. Schoonover of the National Bureau of Standards showed that a small amount of chromium oxide (Cr_2O_3) was the agent responsible for the green tint of the "Akratex" powder.

Table 1.—Data on Four Gypsum Materials Investigated

Material	Manufacturer	Net Weight of Contents of Package	Retail Cost Per Package	Retail Cost Per Pound
Akratex*	Whip-Mix Corporation	5 ounces	$3.35†	$10.72
Diolite*	Detroit Dental Mfg. Co.	1½ pounds	1.10	0.73
Kerr Rapid Stone	Detroit Dental Mfg. Co.	14 pounds	3.15	0.22
Castone	Ransom and Randolph Co.	15 pounds	3.15	0.21

*Said by manufacturer to be specially prepared for use in making indirect inlay dies.

†Included in package was a small glass bottle containing approximately 8 cc. of a red, perfumed, oily liquid. The bottle was labeled "Akratex Die Lubricant."

Table 2.—Comparative Physical Properties of Gypsum Model Materials

1	2	3	4	5	6	7
Material	Water/Powder Ratio	Time of Setting* Minutes	Compressive Strength*		Linear Expansion During Setting†	
			1 Hour Lbs./In.†	1 Week Lbs./In.†	1 Hour Per Cent	24 Hours Per Cent
Brand Name						
Akratex	0.26‡	19	5,500	13,000	0.04	0.05
Castone	0.26♯	13	6,000	13,500	0.12	0.15
Diolite	0.25‡	21	8,000	14,000	0.15	0.14
Kerr Rapid Stone	0.25§	4.5	7,000	13,500	0.15	0.15

*Determination made by method specified in American Dental Association Specification No. 8 for Dental Zinc Phosphate Cement. J.A.D.A., 24:2019, December 1937.

†Determination made by method specified on page 918, Bureau of Standards Research Paper No. 32.

‡Ratio mentioned in manufacturer's literature.

♯Arbitrary ratio selected to correspond with that for "Akratex."

§Arbitrary ratio selected to correspond with that for "Diolite."

PHYSICAL PROPERTIES

Since petrographic tests indicated that "Akratex" and "Diolite" were practically the equivalent of currently used artificial stones, it was decided to compare the physical properties of "Akratex" and "Diolite" with those of two representative artificial stones. (Table 2.)

The mixing directions which were inclosed in the packages of "Akratex" and "Diolite" were followed in the preparation of all test specimens.

If the specimen size[1] for determining the time of setting of gypsum products was used, each specimen would require about $4.50 worth of "Akratex." Con-

sequently, the time of setting was determined by the method specified in the American Dental Association Specification No. 8 for Dental Zinc Phosphate Cements,[2] except that the tests were conducted at room temperature (26° C.). The values derived by this method were found to be nearly the same as those obtained by the method which requires the large specimen. The values on setting time, given in Table 2, column 3, indicate that "Akratex" and "Diolite" have longer setting times than the stone compounds.

gypsums are slightly stronger in compression than the zinc phosphate cements, but the silicate cements are approximately one and one-half times as strong as the gypsums. Copper and "silver" amalgams are from three to four times as strong as the materials in Table 2. None of the gypsum models would be suitable for swaging operations.

The expansion during setting was determined by the method used by Coleman.[3] The expansion of "Akratex" was approximately one-third that of the other materials (Table 2, columns 6 and 7).

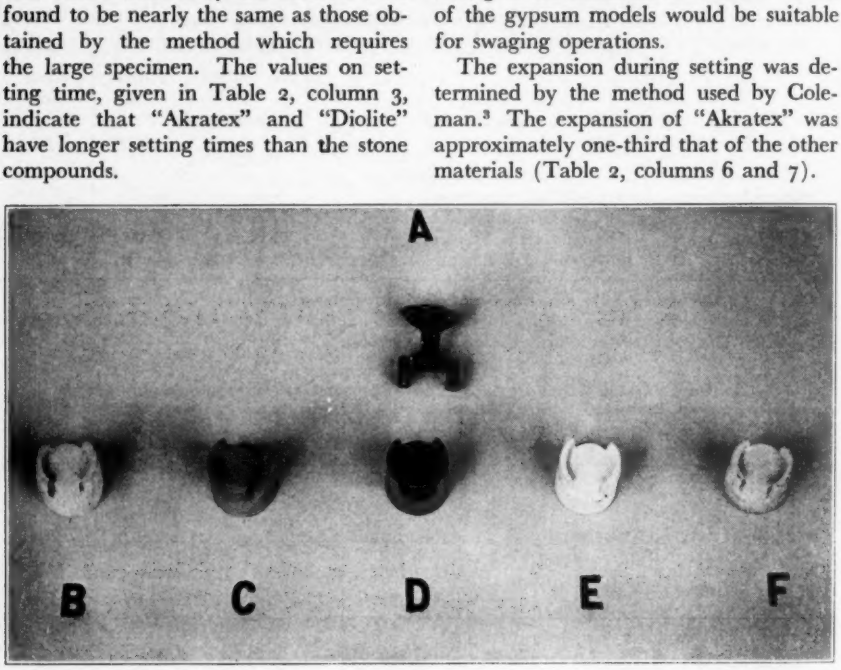

Fig. 1.—Accuracy of indirect inlay models. A, casting which fits steel die, D. B, model made from Kerr Rapid Stone. C, model made from "Castone." E, model made from "Diolite." F, model made from "Akratex." Casting A fits D and all the models with about the same accuracy. The models were poured in hydrocolloidal impressions.

The compressive strengths were determined as specified in the zinc phosphate cement specification,[2] except that the specimens were stored in air at room temperature and 32 per cent relative humidity. A comparison of the strengths at one hour (Table 2, column 4) indicates that "Diolite" has a slightly higher early strength than the other materials. The strengths at the end of one week (Table 2, column 5) were practically the same. At the end of one week, these

SIGNIFICANCE OF DATA

A perusal of the data in Table 2 indicates that the differences between the materials are not important. In order to determine whether these differences are of significance in the actual use of the materials, the following experiment was conducted. Impressions were taken of a mesioclusodistal cavity (the axial walls of which were on a 4 per cent taper) in a steel die (D, Figure 1) with a hydrocolloidal impression material. Models of

the cavity and the top portion of the steel die were made by vibrating mixes of "Kerr Rapid Stone," "Castone," "Diolite" and "Akratex" (items B, C, E and F, respectively, Figure 1) into the impressions. The gold alloy casting (A, Figure 1), which accurately fits the steel die, also accurately fits the models prepared from the four different materials. In fact, the fit is so accurate in each instance that it is not possible to say that one material made a better reproduction than the other. The surfaces of models B and C, however, possessed a higher gloss than did the surfaces of E and F.

The differences in setting expansion (Table 2, columns 6 and 7), although seemingly large, appear to have little or no significance in actual use.

The longer times of setting of "Akratex" and "Diolite" (Table 2, column 3) are in reality a disadvantage, because the model cannot be separated from the impression as soon as is sometimes convenient. Since small models, which are the rule in indirect inlay work, require only a short time interval between mixing and pouring, there appears to be no advantage in the prolonged setting period.

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1. Federal Specification—SS-G-901 for Gypsum: Calcined. For sale by the Superintendent of Documents, Washington, D. S. Price 5 cents.

2. PAFFENBARGER, G. C. and BEALL, J. R.: American Dental Association Specification No. 8 for Dental Zinc Phosphate Cement. J.A.D.A., 24:2019, December 1937.

3. COLEMAN, R. L.: Physical Properties of Dental Materials, Bureau of Standards, Research Paper No. 32, p. 918. For sale by the Superintendent of Documents. Price 35 cents.

COMMITTEE ON LEGISLATION

DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA *re* HEININGER*

SYLVAN B. HEININGER,
Plaintiff

vs.

JAMES A. FARLEY, Postmaster General of the United States,
Defendant

This is a bill in equity to enjoin the enforcement of a fraud order issued by the acting Postmaster General, upon the ground that the official acted arbitrarily and without substantial evidence which would warrant the issuance of the fraud order. . . .

While plaintiff's business may be and doubtless is obnoxious to his brethren in the dental profession, yet there is nothing inherently fraudulent in selling dentures by mail. It is a matter of common knowledge that it is frequently difficult to fit false teeth even where a dentist has a patient before him, and of course the difficulty may be increased where the fitting is made by mail and the dentist never sees the patient. But unless the plaintiff is actually engaged in a scheme or device to defraud, the Postmaster General is without jurisdiction to issue a fraud order. . . .

I have examined the transcript of the testimony before the Post Office Department as well as the memorandum of the solicitor of the Post Office Department, and I am of the opinion that there was

*Extracts from the decision rendered June 3, 1938, by Peyton Gordon, Judge in the District Court of the U. S. for the District of Columbia.

no substantial evidence before the Post Office Department to sustain the decision that plaintiff was engaged in conducting a scheme or device to obtain money through the mails by means of false or fraudulent pretenses, representations or promises. . . .

Three dentists, two of them in Government service, testifying as experts, stated that in their opinion dentures made according to plaintiff's system would not fit perfectly and would not restore to any purchaser full power of mastication and enable him to chew and eat anything with ease and comfort. They also detailed at great length the procedure which they followed in making dentures for patients who were before them.

There was also testimony as to some 50 other cases in which dentures had been ordered from plaintiff. A Public Health Service dentist, two of plaintiff's attorneys and a Post Office inspector visited approximately 50 persons, residing in ten States, who had purchased teeth from plaintiff by mail and whose names were picked at random from plaintiff's files. In each instance the customer was wearing the teeth, stated in writing that he or she was satisfied and well pleased with the teeth, and praised plaintiff. On the same occasions the Government dentist in the party examined the mouth of each customer. He testified that in no case did he find a properly fitting denture made by plaintiff. This witness testified (Tr. 442):

> I could not say that there was a denture in the lot, that I would consider a well fitting denture. The only criticism I would have is that some are worse than others.

It may be very reasonably assumed (and indeed the testimony so indicated) that the persons who purchased false teeth through the mail from plaintiff are not those who live in communities where dentists are easily accessible, or who are financially able to afford the charges of such dentists. Many such persons have gone without teeth for long periods of time. Their gums have contracted and hardened, so that it would be difficult, if not impossible, for anyone to make teeth for them which would adhere to the gums satisfactorily without the aid of powder or some other substance. . . .

The teeth furnished by the plaintiff fitted as the evidence showed they did, the appearance of the purchasers was greatly improved, and unquestionably they could masticate much better than before. They do not need an expert to tell them whether their appearance is improved, or that the dentures are beautiful, or that they fit perfectly, or that they can masticate and articulate as well as they ever could, and to my mind it is no evidence of fraud because, in such a situation and under such circumstances, an expert tells the Postmaster General that such teeth are not beautiful, that they do not fit, that the appearance of the wearers is not improved, or that they cannot masticate with them.

But assuming that the testimony adduced by the Post Office Department was true, and that in not a single one of these 50 cases, chosen from among several thousand, was there a denture which fitted "perfectly" and which restored full power of mastication and enabled the wearer to chew and eat anything with ease and comfort, yet that does not show that plaintiff was engaged in conducting a scheme or device to defraud. Plaintiff never saw these customers, who expressed themselves as being well satisfied with their dentures. Had plaintiff never sent them any teeth at all, or if he had forwarded a plate of standard size to each customer, regardless of the shape and size of his gums, or had the customers complained about the teeth, and given plaintiff an opportunity to correct defects, and he had neither corrected the defects, nor refunded the customers' money, then there might be some basis for a finding that plaintiff was engaged in conducting a scheme to defraud.

In my view the evidence in this case, far from indicating a scheme to defraud, plainly shows that plaintiff was engaged in a legitimate business, in good faith endeavoring to supply dentures through the mails to customers who, in the main, were persons of small financial means living in rural communities.

COMMENT BY CHAIRMAN OF THE LEGISLATIVE COMMITTEE

THE ruling of Judge Peyton Gordon of the District of Columbia District court, June 3, 1938, extracts of which are published above, granting to one S. B. Heininger, whose license to practice dentistry was revoked by the Department of Registration and Education of the State of Illinois a year ago, an injunction restraining the U.S. Post Office Department from enforcing its fraud order issued February 19, an order which was issued after a three-day hearing of Heininger at Washington, D. C., on charges of false and fraudulent practice, will be read with mixed feelings of amazement and bewilderment by the 60,000 dentists of the United States who take justifiable pride in their profession, its attainments and ethics.

The court states that "while Heininger's business may be and doubtless is obnoxious to his brethren in the dental profession, yet there is nothing inherently fraudulent in selling dentures by mail," but these 60,000 dentists will continue to believe that any method of dental practice that is severely condemned as fraudulent and against public interest and welfare, by the American Dental Association, by all dental colleges in the United States and, in short, by all recognized leaders and authorities on dental practice, must be fraudulent beyond argument, legal or moral.

They must wonder if the court would have the temerity to rule as "not inherently fraudulent" a questionable method of legal practice, similarly and unanimously condemned as against public welfare by the law colleges and all outstanding authorities on legal practice. To these 60,000 dentists, it would appear that the so-called "shyster" lawyer, preying on the fear and ignorance of his client, and those persons who would, in matters that concern health, exploit a public particularly susceptible to fraud and deception by methods of practice, condemned by their profession, are brothers under the skin, and not only "obnoxious to" but also held in contempt by their brethren in the two professions.

Whether a method of practice is plainly "fraudulent" or just "not inherently fraudulent" may determine a ruling under certain conditions by court of law. Nevertheless, the end effect, as far as the interests and welfare of the public are concerned, may be identical when such a method is permitted, and it is that end-effect in which public and profession are alike concerned. To endeavor to separate that which is fraudulent in dental practice from what may be considered not inherently fraudulent is to split hairs, and experience has shown that these borderline methods are inevitably dishonest in actual practice.

Our state and endowed university dental departments and colleges and the American Dental Association and its many affiliated societies are all firmly of the opinion that the business of manufacturing dentures by mass production on mail order impressions which, all considered, must be sorry things, cannot be honest, and since the dentist who would attempt such general practice for profit is well aware of the unsurmountable difficulties involved, it would appear that his promises must be inherently false and his mail order business inherently fraudulent.

The legislatures of forty states, seek-

ing to protect the citizens of these states from "fraud" and from what may be "not inherently fraud" in dental practice, have prohibited dentists in these states, for the public good, from using publicity methods promising much for little, on which these mail order denture concerns must depend for existence. These legislatures now find their intent circumvented by outstate concerns located beyond the jurisdiction of their laws and courts, and flooding these states by mail with what are claimed to be false and misleading promises. Even were these claims truthful, the dentists of these states would still by state law be forbidden, for the public good, the use of similar methods of promoting practice and so must suffer from outstate competition that is, from their viewpoint, not only false and fraudulent but also unfair.

Chief Justice Charles Evans Hughes, speaking for the United States Supreme Court, has said: *"The community is concerned with the maintenance of professional standards which will insure not only competency in individual practitioners but protection against those who would prey upon a public peculiarly susceptible to imposition through alluring promises of physical relief, and the community is concerned in providing safeguards not only against deception, but against practices which would tend to demoralize the profession by forcing its members into an unseemly rivalry which would enlarge the opportunities of the least scrupulous."*

If this is so, how then may these state legislatures, whose enacted laws are flouted, continue to maintain within their respective borders a proper standard and proper control of the practice of dentistry and protect their citizens against dental fraud and their practitioners of dentistry against unfair and improper methods of competition? It is to meet just such dilemma that Congress has granted to the Post Office Department and to the Federal Trade Commission authority to investigate, stop and punish those found guilty of improper, fraudulent and unfair interstate commerce. These two Federal Departments have conducted extensive investigation of all these mail order denture concerns, which, to date, has resulted in a "cease and desist order" being issued against Heininger by the Federal Trade Commission prohibiting his further use of proved and admitted false claims that had heretofore appeared in all his advertisements, and following this, on February 19, 1938, the Post Office Department issued its "fraud" order prohibiting him from further use of the mails.

The dental profession will continue an unceasing, vigorous campaign to outlaw this highly improper method of dental practice. Judge Gordon's ruling will no doubt be appealed by the Post Office authorities for hearing before the United States Supreme Court, which we trust will not split hairs where protection of the health and welfare of the people is the real issue.

A. B. PATTERSON, *Chairman,*
Committee on Legislation, A.D.A.
Joliet, Ill.
June 6, 1938

FEDERAL TRADE COMMISSION ACT

A recent Congressional Act, the Wheeler-Lea bill, enacted March, 1938, grants greatly increased authority to the Federal Trade Commission in interstate commerce in drugs, remedies and contrivances where fraudulent claims and representations to improve health or to affect the structure or function of the human body or any of its parts are made.

The term "false advertisement" is now defined by the Federal Trade Commission Act to include not only its ordinary meaning of misrepresentation, but also

failure to reveal material facts with respect to consequences which may result from the use of the commodity under customary conditions. The advertiser must now tell not only the truth, but also the whole truth for the protection of the public.

The United States Supreme Court has said: "The fact that a false statement may be obviously false to those who are trained and experienced does not change its character, nor take away its power to deceive others less experienced. There is no duty resting upon a citizen to suspect the honesty of those with whom he transacts business."

The section of the new act relating to drugs, remedies, contrivances, etc., holds the advertiser and the advertising agency that immediately caused the advertisement to be published or disseminated and also the publisher or broadcaster who actually disseminated it equally responsible, although the agency or publisher may escape responsibility by revealing certain information to the Commission.

This Act carries a penalty of up to $5,000, up to six months in jail, or both, on conviction and, pending issuance of the complaint and its final disposition, the Commission has power to restrain the offender from continuing further advertisements believed by the Commission to be false, misleading or fraudulent.

This new law with teeth in it was, by experience, found necessary in order to protect the public against misleading advertisements of remedies and contrivances that endanger its health and rob it of its money.

COMMITTEE ON LEGISLATION.

A CORRECTION

In the article by Drs. Tainter and Throndson, entitled "Influence of Vasoconstrictors on the Toxicity of Procaine Anesthetic Solutions," published in this department in the June issue, in reproducing the kymograph records the portions of the legends indicating the anesthetics and dosages were inadvertently blocked out and through an oversight were not restored.

Correction will be made in the reprints, and copies will be sent by the authors to those interested.

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American Dental Association

St. Louis, Missouri October 24-28, 1938

HOTEL RESERVATIONS

To secure hotel accommodations for the 1938 Session, consult the rate list and fill out the attached blank. Mail this immediately to the hotel of your first choice or to the Housing Committee, Room 108, Hotel Statler, St. Louis, Mo. Confirmation will be sent to you by the hotel.

Second and third choices of hotel should be indicated. If the reservation cannot be made at any of the hotels of your choice, the Housing Committee will place you in as favorable a hotel as possible and will notify you.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed upon, please write or wire the hotel releasing the room, in order that it may be available for other members.

APPLICATION FOR HOTEL ACCOMMODATIONS

AMERICAN DENTAL ASSOCIATION
St. Louis, Mo. October 24-28, 1938

HOTEL.....1st choice

HOTEL.....2nd choice

HOTEL.....3rd choice

Kindly reserve the following:

.....Rooms with bath for.....persons $.....per room

.....Rooms without bath for.....persons $.....per room

Arriving on October.....at.....a.m.....p.m.

ROOMS TO BE OCCUPIED BY:

NAME	ADDRESS IN FULL
.....	.....
.....	.....
.....	.....

NOTE TO HOTEL NAMED AS FIRST CHOICE: If the hotel of first choice is unable to make the reservation requested, this application should be forwarded at once to the Housing Committee, Room 108, Hotel Statler, St. Louis, Mo.

SCHEDULE OF RATES

ALL ROOMS WITH BATH*

Hotels	*Single*	*Double*	*Twin Beds*
AMERICAN 6 North 7th St.	$2.50	$4.00	$5.00
AUDITORIUM 1803 Pine St.	2.50	3.50	4.50
BILTMORE 3643 Washington Blvd.	1.50	2.50	3.00
CHASE 212 N. Kingshighway Blvd.	2.50–3.00–3.50–4.00 Apartments (4 persons), 12.00	4.00–5.00–6.00	5.00–6.00
CLARIDGE 18th and Locust St.	2.00–2.50–3.00	4.00–4.50–5.00	4.00–4.50–5.00 6.00
CONGRESS 275 N. Union Blvd.			6.00
DESOTO 1014 Locust St.	2.00–2.50–3.00	3.00–3.50–4.00	3.50–4.00–5.00 6.00
CORONADO 3701 Lindell Blvd.	2.50–3.00–3.50 4.00–4.50–5.00–6.00 Parlors (wall beds), 5.00, single; 6.00, double 2 room suites (3 persons), 7.50 Parlor suites, 5.00 6.00–7.00–8.00–9.00 10.00–11.00–12.00	3.50–4.00–4.50 5.00–6.00	4.00–4.50–5.00 5.50–6.00–7.00
FAIRGROUNDS 3644 Natural Bridge Blvd.	2.00–2.50	3.00–4.00	
FOREST PARK 4910 W. Pine Blvd.	3.00 Apartments (2-4 persons), 3.00 person		4.00–6.00
GATESWORTH 245 Union Blvd.	3.00 Suites (4 persons), 8.00	4.00	5.00

*Extra cot, $1.00. Rates on rooms without bath on request.

SCHEDULE OF RATES (Continued)

Hotels	*Single*	*Double*	*Twin Beds*
JEFFERSON 415 North 12th Blvd.	$3.00–3.50–4.00 4.50–5.00–5.50 Suites (single), 6.00 8.00–10.00–17.50 Suites (double), 8.00 12.00–19.50	$4.00–4.50–5.00 5.50–6.00–7.00 7.50	$5.00–6.00–7.00 7.50–8.00
KINGS-WAY 108 N. Kingshighway Blvd.	2.00–2.50–3.00–3.50 Suites, 5.00–6.00–7.00 8.00	3.00–3.50–4.00	4.00–5.00–6.00
LENNOX 825 Washington Ave.	3.00–3.50–4.00	4.50–5.00–5.50 6.00	5.00–5.50–6.00 6.50–7.00
MAJESTIC 200 North 11th St.	3.00	4.00–5.00	6.00
MARK TWAIN 116 North 8th St.	2.00	3.50–4.00–4.50	4.50–5.00–5.50
MARQUETTE 18th and Washington Blvd.		3.00	4.00
MARYLAND 205 North 9th St.	2.50	3.50–4.00	4.00–4.50
MAYFAIR 8th and St. Charles St.	3.00	4.50–5.00–5.50 6.00–6.50–7.00	5.50–6.50
MELBOURNE 3601 Lindell Blvd.	2.50–3.00–3.50–4.00	4.00–4.50–5.00 6.00	4.50–5.00–6.00 7.00
PARKEDGE 4907 W. Pine Blvd.		4.50	6.00
PARK PLAZA 220 N. Kingshighway Blvd.		5.00	6.00
ROOSEVELT 4901 Delmar Blvd.		3.00 (shower only)	
STATLER 9th and Washington Blvd.	2.50–3.00–3.50–4.00 4.50–5.00 Parlor (wall bed), 7.00 single; 9.00 double Parlor suites (2 or 4), 15.00–22.00	4.50–5.00–6.00 6.50–7.00	5.00–6.00–6.50 7.00–8.00–9.00
WARWICK 1428 Locust St.	2.00–2.50–3.00	3.50–4.00–4.50 5.00	4.00–5.00–6.00
YORK 8 South 6th St.	2.00–2.50	3:50–4.00	4.50

BUREAU OF PUBLIC RELATIONS

THE SACRAMENTO DENTAL HEALTH PLAN

By L. G. Brownell,* D.D.S., Sacramento, Calif.

OSLER, Hunter, Mayo and other celebrities of the medical world have warned the public concerning the dangers of dental foci. The idea as it reaches the layman is somewhat like this: "There is no disease so general in its attack on mankind as oral infection. It favors neither rich nor poor, king nor peasant." That is as far as the idea penetrates. It does not crystallize until toothache or general ill health forcibly brings it to mind; and then only in reference to the particular tooth affected or the illness experienced. At this time, the problem becomes one of mechanical correction, with the economic feature paramount in the mind of the majority. In fact, as soon as discomfort has ceased and local comfort is established, the ideas of function and future systematic disorders are thrown to the winds. Cost, then, becomes uppermost in the patient's mind, and he now follows this trend of thought: "Where can a dentist be found who will make this mechanical correction for the least cost?" In his mind, the great problem of mouth health as stated before becomes strictly an economic one.

There is a solution to the foregoing problem if we attack it from the economic angle. It is foolish to fight and squabble with the public over price when we are not strong enough to win. There is a solution which is natural and whereby both the public and the dentist can win. The answer is education of the child.

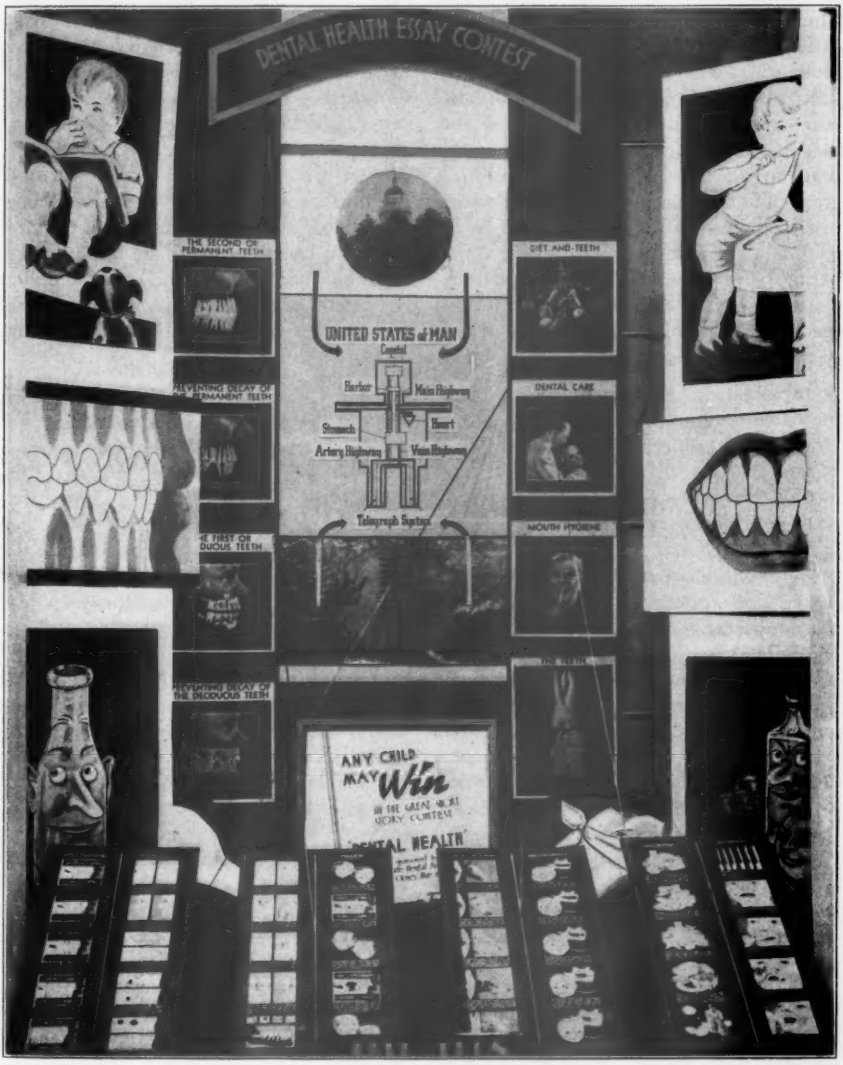
One great fault of our educational program is that accepted professional facts do not reach the public for years. If we use the ideas of our investigators, such as McCollum, why can't we show the public that caries is a disease and not an "act of God"? Why can't we, as a profession, become teachers, in simple language showing the public that although there are many causes of oral infection, such as defects of heredity, glandular dysfunction, faulty metabolism, improper food and lack of oral hygiene, they can, in a measure, control their food supply, and that they can absolutely control their status hygienically. The profession says it is doing this, but, as a matter of fact, it is so much interested in repair procedures that prevention is practically forgotten in most offices.

We have talked for a generation about oral hygiene, with some success. Grave doubts are entertained by some as to the degree of success which would have been possible without the profit motive behind the sale of toothbrushes and dentifrices. In the minds of many, the final result of the control of oral infection by hygienic measures and repair alone is comparable to what happens to our California adobe houses in wet weather. They are fine houses for warmth in winter; they are cool in summer; but they melt like sugar in really wet weather. Repair dentistry and hygiene give a pleasant smile and a clean mouth for a while, but time has not proved that

*District chairman.

mouths so cared for withstand the ravages of present-day conditions.

With the foregoing in mind, the thought behind what we call the Sacramento District Dental Health Plan is evident. The accompanying picture presents this plan in part. That the idea is primarily an economic one is grasped by the public only in part. It is our idea to educate the public from every angle as to how to turn this economic loss into a profit for all. We are first going



Window display of California State Dental Association.

to teach oral hygiene plus preventive diet.

We asked why the state should go to the enormous expense of education and find at the end of fifteen or twenty years, when experience has advanced that education, that many are in the county hospital, a burden to the taxpayer. Why should every purchase be taxed to maintain expensive educational facilities and then personal possessions be taxed to the limit to alleviate suffering, when, in a great measure, the illness is not necessary provided health education has been complete? In other words, every occupant of every county hospital and indigent farm is an economic loss to his respective community from two angles: a partial loss in money invested in education and an almost total loss when the recipient becomes a dependent.

To be more specific: Why tax production to educate, at the same time allowing many preventive foods to go to waste at the point of origin? Also, why tax humane endeavor to care for the unfit when we can, in a great measure, prevent sickness by promoting the use of a preventive diet and by establishing correct oral habits from all angles with the educational facilities at hand? The conclusion seems reasonable that, since we teach calisthenics for the one purpose of promoting the growth of the child, we should meet the demands of growth with proper foods to build and maintain a strong, healthy body.

THE AMERICAN MEDICAL ASSOCIATION'S STUDY OF MEDICAL CARE

LAST March the American Medical Association appointed a special committee known as the Committee on Supply of Medical Service. This committee is to serve in an advisory capacity to their Bureau of Economics in the conduct of a nation-wide study of medical and preventive medical needs with a view to developing a more complete distribution of medical service.

The new committee will endeavor to stimulate state and county medical societies to determine the need for medical service in each county, including that available for the low income and indigent groups.

The American Medical Association hopes to secure the cooperation of public health officials, dentists, hospitals, community chest officers, nursing, pharmaceutical, social service and similar groups in each county so as to obtain a complete picture of health needs and facilities.

A questionnaire consisting of eight forms has been mailed to the secretary of each state and county medical society. These request information on medical and dental practice, hospitalization, nursing services, health department activities, health services rendered by government welfare and relief agencies, public, parochial and private schools; colleges and universities and fraternal, community and similar organizations.

The Board of Trustees of the American Dental Association has agreed to cooperate with the American Medical Association in this study. On May 11th, Dr. Harry B. Pinney, Secretary of the American Dental Association, notified the secretaries of each state and component dental society of the desire of the Board of Trustees of the American Dental Association that state and component societies cooperate and render such assistance as may be requested of them.

DISTRICT HEALTH CENTERS AND THEIR DENTAL PROGRAMS

By JOHN L. RICE,* M.D., New York City

WITH the growth of New York City to its present size—7,000,000 people scattered over 300 square miles—there has come a need for an effective method of bringing public health work close to the people. For many years, fire and police departments in large cities have recognized that better service can be rendered by the establishment of district stations. Similarly, the health department believes that its new program of district health centers will result in more effective service to the people, first by bringing health services closer to them, and secondly by offering a means of obtaining more intimate knowledge of the needs and resources of local areas.

The idea of health centers is not new. Voluntary health centers, such as Judson and Mulberry, have made substantial contributions to welfare. The official health center program of the health department began in 1916, when S. S. Goldwater, then commissioner of health, created the first health district in Manhattan, under Alfred E. Shipley. In the following year, under Haven Emerson as commissioner, several health districts were established in Queens. These initial attempts, however, were not continued. In 1921, the East Harlem Health Center Demonstration was established by the Red Cross and twenty-two cooperating agencies, nine of which were housed in the health center. There, for fifteen years, the agencies have shown the values of a program for a community in which the work of all agencies is closely interrelated and, therefore, intensified. In 1925, under the department of health and the Milbank Memorial Fund, the Bellevue-Yorkville Health Demonstration was established. It made substantial contributions, during the next ten years, in the working out of health procedures as applicable to a district program. In 1930, the city established a small health center in the Negro district of Central Harlem where health problems were most striking. There began the task of gearing local official machinery back into the machinery of the central office.

In 1934, the present official program of health center development was finally launched. A bureau of district health administration was established with a full-time director. Seven full-time district health officers were appointed to those districts in which there could be no question of the need for intensified health services. Since that time, there has been a continuous development of the program. Seven additional health officers have been appointed to districts. The transition from a borough to a district administration progressed until, in 1937, a point was reached where it became most effective to place the entire city under the district plan. This was accomplished by detaching some of the more experienced members of the health department staff from their former duties and assigning them as medical officers-in-charge of

*Commissioner of Health.

Read before the General Session of the Greater New York Dental Meeting, December 6, 1937.

certain administrative areas. Eight such assignments were made. There is now a total of twenty-two health districts and administrative areas, embracing the entire city.

A fundamental art of the work has been to gear the district administrative procedures smoothly into the functional or bureau organization of the central office. There are thirteen bureaus in the health department, each concerned with a functional division of the work under a director, who plans that special work for the entire city. Of these thirteen bureaus, those dealing with services closely related to individuals have been localized for administration by the district health officer. These include nursing, child hygiene, school hygiene, dental care, tuberculosis, social hygiene, health education and district records and statistics. Localization of others such as the control of preventable diseases and certain types of laboratory work is in a transition stage and the localization of such services as food and drugs and sanitary will be a question of future policy.

Aside from the health department, there is another very important organization closely related to the district program, the Committee on Neighborhood Health Development. This committee, composed of leaders in the fields of health, medicine and welfare in the city, was organized in 1929. Its work, representing community-wide interests, has been carried on through subcommittees. Among the more important of these are the Technical Advisory Committee, the Nursing Advisory Committee and the committees on health district boundaries, school health study, district cooperation with the medical profession, neighborhood organization and district cooperation with the dental profession. The last three committees named have a direct relation to the health program of the thirty districts as they are the parent bodies of the various district committees. It is through these committees that the local dental and medical professions and neighborhood leaders actually participate in formulating the health program of the area.

With the development of the district administration, it has become apparent that the intensive study of his district by a health officer reveals many needs which have heretofore been concealed in the larger borough or city studies. Tuberculosis offers an illustration of this.

The death rate from tuberculosis (all forms) in New York City had declined from 280 per hundred thousand in 1900 to 59 in 1934. This is an excellent record and the health officials might well feel, judging from this alone, that tuberculosis needs little further work in order to be eradicated. However, the director of the bureau must have further details concerning the elements in this tuberculosis death rate in order to plan his program effectively.

For example, in one borough, Manhattan, the tuberculosis mortality rate for the years 1929-1933 was 119 as compared with a rate of only 66 for the city. Further, if we divide the borough into health districts, we find a variation in the rate from 68 to 247. Obviously, before we can decide on a control program, the director must further investigate the three districts whose rates are 247, 155 and 131, respectively. The health officer is in a position to know intimately the conditions within his district which may contribute to this problem. For example, the rate in the East Harlem Health District for the years 1929-1933 was 131. When the district is subdivided into smaller units, known as health areas, there is found a variation within the district during these years from 69 to 220. Four health areas had tuberculosis death rates of 160, 168, 208 and 220, respectively. In three of these areas is found a concentration of Puerto

Rican population and, in the fourth, a concentration of Negroes. Furthermore, it has been found that many of the people from these parts of the district did not attend the tuberculosis clinic situated in Health Area 22. The answer to the problem was an intensified tuberculosis control program for the four health areas with the high rates, including a rapid x-ray survey in this area and the establishment of an additional tuberculosis diagnostic clinic in the Meinhard Health Center, which was conveniently located for the population group concerned. These four small "sore spots" would have been entirely concealed if consideration had been given only to city or borough rates.

District administration has been fortunate in the development of a building program for new health centers by the city in conjunction with the Federal Public Works Administration. The first district offices were located in temporary quarters. However, it was realized that if public health is to be dignified in the minds of the citizens of a community, it gains immeasurably through having a suitable headquarters building for that district. The city has purchased one building and remodeled it for a health center.

In addition, during 1937, eight new health centers erected under PWA have been completed and officially opened and the ninth will follow this month. The city has appropriated funds for two more, to be completed in the fall of 1938, and two others have been approved in the capital outlay budget of 1937.

These are substantial, well-planned buildings, which will house clinic services, administrative offices and certain of the voluntary agencies operating in the district and also provide, through an ample auditorium, facilities for community meetings held by various organizations.

A further forward step in public health work is contemplated utilization of five of the new health districts for teaching centers in a cooperative effort of the health department and the five medical schools in New York City. In this way, medical students will be given better facilities for practical training in preventive medicine as it is carried on by the various bureaus of the department of health, and the medical schools will make available to the personnel of the department opportunities for postgraduate work. The five teaching centers will cooperate with the medical schools as follows: Washington Heights with the College of Physicians and Surgeons, Columbia University; the Kips Bay-Lenox Hill with the Cornell Medical College; the Lower East Side with the New York University College of Medicine; the East Harlem with the New York Medical College and Flower Hospital, and the Red Hook-Gowanus with the Long Island University Medical College.

Through more effective administration, extension of health services based on demonstrated needs, intelligent and informed community interest and a teaching program of broad vision, the district health administration is building a sound foundation for the health of New York City.

That is our plan of district health administration.

As I have stated before, the aim and purpose of the center is to bring health to the people. Dental health is of great importance and so deserves our serious attention. We realize too the enormity of the problem. I emphasize it here because it is only by the cooperation which each and every one of you can give that dental caries, the most common defect among school children, can be prevented or controlled.

We have local committees, and dentists have been appointed to the health committees where such committees have

been developed and organized. These local committees will have the benefit of the advice and consultation of the Dental Advisory Council of the Committee on Neighborhood Health Development. From time to time, the various local committees will meet with the advisory council to discuss the local problems, with the hope that we may be able to curb the progress of this most common defect, and control or prevent it.

You are of course familiar with our school program of dental health education and prevention. I wish to show briefly what we are accomplishing by following the program. When we started, we encountered many difficulties. At the end of the January school term, January 31, 1937, we were able to show only thirty-four classes with all dental defects corrected. In this group of 1,208 children, we found only two needing no dental care. Of the 1,206 remaining, 583 cases were treated and completed at the offices of the neighborhood dentists and 623 were treated and completed at the Health Department Dental Clinics.

At the end of the June term, 1937, we were able to show 105 classes with all dental defects corrected. These classes had a total registration of 3,634. Of this group, ninety-one were found to be free from dental defects, 3,543 remaining that needed treatment. The private dentists reported completing 1,787 cases in this group, and the health department clinics treated and completed 1,756 cases. This shows that there must be a cooperative spirit in any community to obtain 100 per cent correction. Communities are made up of indigents, semi-indigents and an "able-to-pay" group; and the profession treated 51 per cent of the children in this particular group. Because of the concentrated efforts along preventive lines, seventy-five of these classes were in the kindergarten to the 2B grade, an age group from 5½ to 8.

The health centers, as has been said, will have dental service as one of its major activities. It is our intention to use these facilities to increase the dental health education activities to include the prenatal group and the preschool group. The health center program will also advance health education and the preventive program of the school clinic by caring for emergency cases and all children above the 4B grade who are now treated at the school clinic. The school program will therefore be entirely educational and preventive and limited to the younger children (kindergarten to 4B). To bring about a better understanding of the medicodental relationships in the prenatal period, the maternal, the child welfare and the dental departments will cooperate in a consultation service to be established for this group, and a new service will be established for the preschool group. This phase will, I hope, bring us closer to an understanding of the problem and to a reduction in the prevalence of dental caries.

Although our services will be limited, a good beginning has been made.

In the budget for 1938, dentistry has received the largest increase in the history of the dental activities of the department of health. The dental division was allowed the appointment of twenty dentists, part-time, and twenty dental hygienists, full-time, calling for an increase of about $50,000, nearly one-third of its present budget.

The district health administration and district health centers will permit us to deal with local problems in a more efficient manner and with methods adapted to the particular districts. The problem of dental caries is a complex one and a very important consideration in the field of public health. I shall count on the dental profession to assist us in the solution of this problem from an economic, social and public health point of view.

OUTLINE OF PROCEDURE FOLLOWED BY THE DENTAL SERVICE OF THE CITY-COUNTY HEALTH UNIT, EL PASO, TEXAS

By P. P. Rodriguez, D.D.S., El Paso, Texas

IN the Fall of the year (September, the beginning of the scholastic year), the two dentists in the city-county health unit in El Paso, Texas, begin the inspection of all school children in the grammar schools, both public and parochial, in the three counties under the supervision of the health unit. The inspections are charted in the office by WPA and NYA assistants, and notices of defects or absence of defects are sent to the parents, through the school nurses and teachers. The dentist is accompanied to the schools by the public health nurse and his assistant, who records all defects and recommendations, using Palmer's charts. Duplicates are made, one for the school record and one for the health unit. The parents designate whether the child will be taken to the family dentist. If they are unable to provide private dental care, they give consent to have the child taken to the dental clinic in the health unit. On investigation by the nurse and with the written consent of the parent, the child is sent to the clinic, where the necessary work is done gratis. A registration fee of 25 cents is asked of those who are able to pay. In the office, the school examinations are analyzed and a survey is made, counting all defects and all defective persons. Individual school reports are made showing the numbers and percentage defective. These are sent to the principals and the state health department.

The "honor roll system" is used in all schools. Children with no defects are placed on the roll; the others strive to have their names placed there also and can do so by having the necessary corrections made. Certificates are issued, to be signed by the dentists.

In the clinic, which is open every day of the week except Saturday afternoon, amalgam, cement and silicate fillings are placed, and examinations, extractions, scalings, prophylaxes and all treatments are carried out.

Corrective work is also done in the county schools, consisting mostly of extractions, scalings and treatments. The work is done in the health centers, if there is one, or in the health room in the schools. Portable equipment is used. The dentist is accompanied by the public health nurse and assistant. The longest distance traveled is 150 miles one way.

In the second semester of the scholastic year (at the end of January), the school inspections are completed and the statistics compiled. Then the educational phase of the program is started in the schools. The two dentists visit each room and give lectures on dental health and descriptions of the teeth, oral bacteria, etc. Toothbrush demonstrations and drills are given, using models of both the permanent and the deciduous teeth. Toothbrushes, charts and cross-section molar models are also used.

What literature is available is distributed. "Jimmy Chew" booklets were used last year and primary grade leaflets from the American Dental Association. Films are rented from the Association and shown in the schools from time to time.

OTHER FEATURES OF THE EDUCATIONAL PROGRAM

1. The dental auxiliary of the El Paso County Dental Society sponsored an essay writing contest on dental subjects.

2. The El Paso County Dental Society at its December 14, 1937, meeting passed a resolution to support the A.D.A. Poster Contest in cooperation with the Dental Department of the City-County Health Unit. They voted part of the prize money. A committee was appointed to act with the district chairman and the health unit dentists to contact service clubs for prizes and the school authorities.

3. Weekly radio programs are sponsored by the El Paso County Dental Society, the talks being obtained from the American Dental Association.

4. The dental department dispenses toothbrushes at cost, obtained at wholesale prices. An average of three gross a month are dispensed.

NATIONAL DENTAL HEALTH POSTER CONTEST IN PENNSYLVANIA

THE members of the Pennsylvania State Dental Society, the art instructors and other teachers and the children of the state responded enthusiastically to the call for competition in the National Dental Health Poster Contest. Though we do not have accurate reports, it is conservatively estimated that more than 20,000 children entered the contest and made posters. The call for action was sent out by the poster committee chairman to the component and branch societies and the response was an inspiration to him, in that immediate action was evidenced in practically every part of the state, which was indicative of real interest.

In community, county and district contests, the prizes were in the form of cash awards of various amounts. The chairman of the poster committee attended several of the exhibitions and judgings and noted the high character of the judges and the fairness with which they acted. The prizes awarded by the state dental society were as follows:

The first prizes in all groups were candid cameras; the second prizes, Shaeffer pen and pencil sets; the third prizes, an excellent grade of water color paint sets. Thank-you letters were received from all prize winners in the state contest. I copy one of these letters:

Altoona, Pa.
May 1938

Dr. C. J. Hollister,
Harrisburg, Pa.
Dear Sir:

I received the pen and pencil set you sent me as my award in the poster contest.

I wish to thank you and all others who made this contest possible; also the judges for awarding me second place.

My teachers are very proud of me and I am more than proud to be a winner for Jefferson school.

Again thanking you, I remain

Sincerely,
(Signed) Joan Gority

At this point, I desire to commend those who prepared the poster contest rules because every question asked me by poster contest chairmen was answered by simply mailing the reprint carrying the suggestions and rules. Many communities followed the suggestions literally by holding community meetings with dental health as the subject and making a dignified ceremony of the presentation of local prizes.

At the time of this writing, there are several communities represented by state prize winners who are holding special

Winning posters in Pennsylvania State Dental Health Poster Contest, May 1938.

ceremonies to present the children who made the prize winning posters with their Certificate of Award.

In closing this report, the chairman cannot refrain from expressing the thought that, to his mind, this has been one of the biggest things the American Dental Association has ever done to promote interest in mouth health. He also desires to bring to the attention of those responsible for this contest that it is the opinion of all who took part in this contest that it should be an annual affair launched each year at the beginning of the school term. In spite of the hard work done by the local committee chairmen, practically all of them expressed the foregoing opinion.

C. J. HOLLISTER, D.D.S., *Chairman,*
Pennsylvania State Dental
Health Poster Contest Committee,
Harrisburg, Pa.

GEORGIA'S REFRESHER COURSES IN CHILDREN'S DENTISTRY

REPORTS received from J. G. Williams indicate that Georgia's recent refresher courses in children's dentistry were exceptionally successful.

The course was presented by the state department of health and sponsored by the Georgia Dental Association. Walter C. McBride, of Detroit, gave the lectures and clinics.

Five full-day courses were held in strategic points throughout the state: Albany, Waycross, Swainsboro, Athens and Rome. This enabled the dentists from the adjacent territory to avail themselves of Dr. McBride's practical presentation. Following is a copy of the program.

REFRESHER COURSE
IN
CHILDREN'S DENTISTRY
presented by
State Department of Public Health
sponsored by
Georgia Dental Association

Albany	May 23
Waycross	May 24
Swainsboro	May 25
Athens	May 26
Rome	May 27

Dental health and dental health education are an important part of the Georgia public health program. It is with pride that we announce the refresher course in children's dentistry, the first to be conducted by a state health department. In all phases of preventive medicine and dentistry, we must begin with the child. Refresher courses for physicians and dentists are designed to make our services more efficient. The dentists of Georgia have made a great contribution to the health of our people. May you continue to serve.

T. F. ABERCROMBIE, M.D., *Director,*
State Department of Public Health.

PROGRAM

Morning Session

10:00 a.m. Opening talk by local chairman.
Introduction of speaker.
10:10-11:40 a.m. "Clinic and Operative Dentistry for Children," by Walter C. McBride.
11:40-12:15 p.m. "From the Public Health Point of View," by J. G. Williams.
12:15 p.m. Adjournment for lunch.
12:30-1:45 p.m. Luncheon.
Discussion of morning program.

Afternoon Session

1:45-2:15 p.m. "Business Phase of Dentistry," by Walter C. McBride.
2:15-2:45 p.m. "Management of Child Patient," by Walter C. McBride.
2:45-4:00 p.m. Clinic, with children for demonstration, by Walter C. McBride.
4:00 p.m. Adjournment.

DENTAL ECONOMICS

FEES

By Joseph R. Horn, D.D.S., New York City

HOW TO DETERMINE A FEE

THERE must be a basis for fees in a private practice. A charge is based on: 1. The responsibilities attached to the service. 2. The time required to render the service. 3. The contingencies and after-care involved. 4. The personal ability of the dentist. 5. The laboratory charges and materials used in technical work, as in prosthetics. 6. Office maintenance.

The responsibility involved is the most important factor; for instance, in the removal of a broken-down, retained root with an infected area surrounding it. The liability in performing this operation is greater than in a simple extraction. The contingencies must also be taken into consideration. These two factors will enable the dentist to determine what his charge will be.

It is best to have in each office an established fee schedule for the routine services according to the standards of practice and the fees which have been current in the community.

A fee schedule can be determined by the average fee for routine cases over a period of years. The dentist should not attempt to sharply increase his fees.

An increase in fees is frequently the cause of the collapse of a prosperous practice. If the increase is so great that the clientele talk about it and it becomes a subject of community gossip, there is a definite reason for the loss of patients. Eventually, the dentist will get a reputation of being "high priced."

Wherever there is an increase in fees to the extent that it imposes a hardship on the patient, the practice will suffer by the elimination of the regular patient. It is this group on which the practice is usually dependent for a steady income, not the fabulously wealthy group. It is not a good policy to attempt to weed out all the poorer patients, because this also will aid in the destruction of the practice, as some consideration must be given to these people.

Sharp increases in fees will be resented by the older patients. An increase in fees which will affect this group can be established without creating an attitude which might cause loss of these patients. The increase in fees must be a small percentage (usually not more than 10 per cent). The secretary can play an important rôle here, because she can help in explaining such an increase to the patient, who must be satisfied that it is a just increase.

The responsibiilties of the operator are many in the field of dentistry. If there were no legal nor professional responsibilities, we would have little on which to base our fees. The dentist himself must decide, when examining a new case, how to proceed with the work, and what responsibilities will be involved from the commencement to the completion of the services.

The case might be quite simple or it

Read at a meeting of the Baltimore City Dental Society, February 9, 1938.

might be difficult. For instance, in treating lesions of the tissues or acute Vincent's infection, the dentist assumes responsibility for the recovery of his patient. Here, he must be careful to see that his patient cooperates with him fully in his office as well as carries out all instructions in home care.

Extreme care should be exercised in diagnosing a case that involves periodontic treatment, as the course of treatment and the remuneration will depend on proper diagnosis.

In prosthetic work, the responsibilities are many. Should the findings reveal that the case is difficult, dealing with hard tissues, or a lower ridge which has been extensively resorbed, we know that more than the usual time and effort will be required to construct a denture which will be satisfactory.

The responsibilities are just as great in all the other fields: ceramics, exodontia, surgery, root-canal therapy and general operative work.

In operative work, the basis for the fee rests on the extent of decay, the preparation necessary and the type of restoration. However, the responsibility here lies in the attempt to save the tooth, and it increases if the tooth is in a state of advanced decay.

In preventive dentistry, the chief responsibility lies in the education of the parent to the necessity of keeping the deciduous teeth in good condition, by means of the diet, home care and training of the child to respect and not to fear the dentist's service.

Although the time element must also be considered in determining a fee, it is by no means the all-important factor. Many men base their fees entirely on the time involved, but there are many reasons why this is bad practice. The young practitioner, who does not have an established practice, could not base his fees on time alone, as he has many open hours during the day. Then, with the well-established practitioner, there is a tendency for the dentist and the patient to concentrate too much on the clock and to overlook more important phases of the service. A just remuneration cannot always be determined in an office where time is all important, because it is difficult for the average man to know exactly how much his hour is worth to him. Of course, there are exceptions, as in the case of the periodontist, in whose office or practice time is the most important factor. In general practice, there is sometimes an unavoidable delay on the part of the patient or dentist, overlapping of appointments, etc., which may lead to misunderstanding, discussion and even occasional loss of a patient.

The many contingencies, the things that are liable to happen during or after a course of treatment, have been covered under the subject of contingencies. In determining the fee, and prior to its presentation to the patient, such eventualities must be considered, as they affect the problem to a great extent—the greater the contingencies, the higher the fee. Where there are no contingencies, the fee can be a nominal one.

The personal ability of the dentist is important. We take it for granted that every man who is graduated from a college of dentistry is equally qualified for the practice of dentistry. Still, after he has practiced dentistry for a few years, he may become more proficient in some phase of the work. Let us take the man who has a great love for surgery and has served many years in a hospital or clinic studying and taking care of many cases. He will become more proficient in this branch and should be entitled to a larger fee for this type of work. This applies to any other branch of dentistry, in which a man may have more ability in some particular department of practice, so that his clientele recognize his special ability.

The laboratory charges and materials used should also be considered in the

fee. If a prosthetic case involves the casting in gold of a full denture and the total charge, including materials, is considerable, this fact must be taken into consideration in preparing a fee. Of course, such laboratory charges vary in different cities and communities. In some places, it has been the custom to charge three times the laboratory cost and in other places as high as five times. Laboratory charges depend on the type of laboratory one deals with and the type of work produced. Some men do their own work and therefore must know the cost of materials and metals which are used.

The maintenance of the office plays an important part in the success or failure of the practice. The dentist who is very busy and working full time, with many patients, but who, at the end of the month, finds that expenditures have been almost as large as income, cannot prove successful. The total upkeep of an office should be kept within 30 to 40 per cent of its income.

It is difficult to draw definite conclusions from analysis of cross-sections of practices, because here again the expense of keeping an office depends on many conditions, such as type of community, type of building, clientele and the actual financial resources of the dentist.

Fees, therefore, should be based on consideration of all the foregoing factors, or any combination of these factors, depending on what type of service is to be rendered.

There should be no haste in presenting a diagnosis, but after this is done, the fee can be presented. It is a mistake to name a fee unless the patient definitely understands the condition of the mouth and the services to be rendered. Where there is haste in naming the fee, failure will result. A definite time should be set aside for this consideration, during which there should be no interruptions. Interruptions during the discussion of the fee would result in loss of the patient or perhaps in failure to make a contract which is the best possible for dentist and patient. Anxiety on the part of the dentist, secretary or patient will also result in failure.

CASE HISTORIES

CASE 1.—A girl, aged 18, consulted a dentist and for the work necessary a fee of $175 was agreed on. The patient paid one-third of the fee and agreed to pay the remainder on completion of the work. The dentist proceeded until the work was completed and, on the last visit, the patient's father came in with her and expressed indignation over the fact that he was not consulted in the matter in which an expenditure of $175 was involved. After much discussion, a compromise was made, a reduction of $65 being allowed from the total fee.

The dentist and the secretary were placed in a defensive position because the parent had not been consulted prior to the commencement of the work.

CASE 2.—Mr. J. agreed to dental services as outlined and the fee to be paid, but there was no definite arrangement as to how the payments were to be made. The prescription called for prosthetic work which involved a high laboratory charge.

The dentist proceeded with the work, and, one week before completion of services, the secretary called his attention to the fact that only half of the fee had been paid and a substantial balance remained. After a consultation between dentist and secretary, the patient was asked to pay the remainder. This caused resentment on his part and although the matter was finally adjusted, hard feelings were the result. The mistake made in this case was failure to arrange for a definite schedule of payments, the blame falling on the administrative end of the practice.

CASE 3.—A young man visited a dental office for restoration of an anterior tooth, an upper right central incisor. The simple cavity required merely a plastic porcelain filling. The patient was pleased with the work and paid a nominal fee. A few weeks later, his brother noticed what appeared to be a similar condition in an upper anterior tooth and visited the same dentist. On examination, deep decay was found in the tooth, involv-

ing treatment of the pulp and extensive restoration. Without telling the patient what he intended doing, the dentist proceeded diligently with the work and completed the restoration. The fee in this case was larger than the brother's and the patient protested, stating that he was under the impression that the work done was similar to that done for his brother and that therefore the fee would be the same. The matter was adjusted, but it resulted in the loss of this family as patients. The matter of the fee should have been taken up with the patient before the work was started.

CASE 4.—A patient was charged a high fee for a considerable amount of work. During the progress of the work, the dentist found an additional decayed tooth and advised the patient that there would be an additional charge. The patient failed to return, and, on investigation, it was found that he resented the addition to the original fee. The record disclosed that the original fee was $375. The additional charge amounted to $12. The mistake here was making an additional charge after the original fee is given and agreed on without advising the patient beforehand of the possibility of an additional fee.

DON'T'S REGARDING FEES

1. Do not name a fee unless diagnosis and prescription have been completed.

2. Do not take up the matter of a fee unless the patient is fully relaxed.

3. Do not be hasty about the matter of fee presentation. Haste on the part of patient or dentist during this procedure will break into the train of thought that should be given to this important matter. If the matter is hurried, many factors will be overlooked.

4. Do not take up the matter of the fee with a patient who has no confidence in you. If the time to discuss the fee has come and a patient is found lacking in confidence in the dentist, it is best to lose the case rather than continue discussion of the fee.

5. Do not proceed with dental service unless the patient has a complete understanding of the fee and of the schedule of payments.

6. Do not permit a discussion of fees to take a commercial turn when considering an allowance or a discount. The discount should be based upon the circumstances of the patient only, as otherwise it is on the basis of bargaining.

7. Determine a fee only on the basis of your responsibilities and the contingencies involved.

8. Do not add any additional charges to the original fee after all contractual arrangements have been consummated.

9. Do not increase your fees to a marked degree, as this in many cases works an undue hardship on the patient and has an untoward effect on the older patients, who have been accustomed to certain fees.

10. Do not discuss fees with a minor. It is advisable to have the parent, guardian or others responsible for the payment of the fee present, in order to have them understand the diagnosis and outline of work. Of course it is not always possible for the parent or guardian to come in. In that case, it is advisable to communicate with the parent or guardian by telephone and confirm all arrangements by mail.

11. Do not discuss the fee with a patient who is dependent on some one else for the final decision. It is advisable to suggest that this consultant be invited in to discuss the findings and the matter of the fee.

LOW INCOME GROUPS

The office that is weighed down with a great number of the low income group is practicing under a handicap. In the average practice, there is generally a small group of such patients. The question usually is: What is to be done with this group?

1. Should such patients be dismissed because they cannot pay the customary fees?

2. Should an allowance be made based on the circumstances of the patient?
3. Should credit be extended?
4. Should partial work be done?

It would be illogical and unwise to dismiss such patients. Following are possible procedures:

1. Extend credit or make an allowance on the fee. In making an allowance, the dentist must study all factors. Whether operative, surgery or prosthetic work is to be performed must be considered. Any laboratory expense and the use of precious metals must be given serious consideration.

Allowance should be made only because of the financial circumstances of the patient. It should not be made as a result of bargaining between patient and doctor. The patient should understand that the allowance is given only because the doctor wishes to help the patient.

The dentist must study the work outlined and decide whether he can proceed with the service necessary and allow the patient to make payments over a certain time, usually not exceeding ten months. Many facts must be considered. The patient must be of good standing and good character. When this requirement is met, a budgetary plan fair to both dentist and patient must be outlined. To burden the patient with too large payments would result in failure of the case and disappointment on the part of the patient. It might even end in the loss of the patient. If payment is carefully planned to be within the means of the patient and is based on a regular schedule, all obligations will be met by the patient and he will greatly appreciate this service.

This credit service might be offered to patients who do not, for some reason, wish to carry a heavy debt over a long period of time. In that case, the next logical step would be to recommend that the most urgent work be done immediately; in other words, partial work is suggested. Of course, the outline of the partial work should be explicit so that there will be no misunderstanding at any future time as to what the original fee for completion of the work was and what the partial fee is.

It may be advisable to have a written contract in a case of this type.

CONTRACT FOR IMMEDIATE PRESCRIPTION

(This is not to be mailed, but is taken up at the office, if a copy of the diagnosis and prescription is to be given to the patient for immediate prescription.)
PATIENT'S NAME_____ DATE_____

Attached please find copy of diagnosis and prescription already outlined to you verbally.

The fee for the dental services outlined therein under "Immediate Prescription" is $_____ payable by you as follows...

.....

If the diagnosis, prescription, fee and payment arrangements stated above meet with your approval, kindly signify your acceptance by writing your name on the duplicate.

DISCOUNT OR ALLOWANCE

(Contract to be signed; allowance made for circumstances; not mailed.)
PATIENT'S NAME_____ DATE_____

The fee for the dental services outlined to you is $_____.

In view of your financial circumstances at this time we are making an allowance of _____% or $_____ on this amount, the balance of $_____ payable by you as follows:

If the diagnosis, prescription, fee and payment arrangements stated above meet with your approval, kindly signify your acceptance by writing your name on the duplicate.

SPECIFIC RULES GOVERNING LOW INCOME GROUP

1. The patient must be referred by some one of authority.
2. The patient may be the member of

an old family of patients whose standing is a very good one.

3. The patient must understand what the usual fee is.

4. The patient must understand what allowance or discount is made off the regular fee.

5. A definite payments schedule should be made. A budget should be planned that would not work an undue hardship on the patient. Usually, a weekly payment plan is best.

6. Any discount or allowance should be based solely on the circumstances of the patient.

7. Any discount should range from 10 to 25 per cent, rarely exceeding 25 per cent, as any greater discount would eventually prove a financial handicap to the office.

FEE CONFIRMATIONS

CONTRACT

PERIODONTAL TREATMENTS

(To be mailed—no signature necessary.)

PATIENT'S NAME_____ DATE_____

This is to confirm our verbal agreement that Dr._____ is to render a series of treatments for the purpose of restoring your gums and maintaining them in good condition.

It is understood that you are to give Dr._____ twenty-four hours' notice if you wish to cancel any appointment previously made. Appointments should not be broken as the success of the treatments depends on the regularity of your visits.

The treatments will extend over a period of _____ months and will require at least _____ visits per month.

The fee for the service is $_____, payable as follows:

Initial payment of $_____, and the balance in _____ successive payments, at $_____ a payment.

The patient is to carry out all instructions in home care as indicated on the instruction sheet.

If we do not hear from you to the contrary, Dr. _____ will proceed with the treatments as outlined to you.

(To be mailed—no signature necessary.)

This is to confirm our verbal agreement to the effect that Dr._____ is to give you a series of treatments for the purpose of restoring the periodontic condition of your mouth and maintaining it in good condition. It is contemplated that these treatments will extend over a period of _____ months.

The fee for the entire service is to be $_____, payable _____.

It is understood that the patient is to carry out all instructions on the attached sheet if we are to hope for the desired results.

Yours very truly,

_____D.D.S., or Secretary.

CONFIRMATION FOLLOWING PRESENTATION OF FEE

This is taken up in the office after presentation of written diagnosis and prescription and fee. The patient signs the duplicate for office files.

PATIENT'S NAME_____ DATE_____

Attached please find copy of diagnosis and prescription, which have already been outlined to you verbally.

The fee for the dental services outlined therein is

$_____,

which is payable by you as follows:

If the diagnosis and prescription, fee and payment arrangements stated above meet with your approval, kindly signify your acceptance by writing your name on the duplicate.

Some men have found it advisable to give their patients a written résumé of the findings in the mouth and services to be rendered, whereas others simply tell their patients verbally what will be done.

CONTRACT FOR GENERAL WORK—MONTHLY PAYMENTS

(Confirmation through mail)

NAME_____ DATE_____

Dear_____

I hereby take pleasure on behalf of Dr._____ in confirming the arrangements made between you on_____.

Dr._____ is to provide dental services to the amount of $_____, which is payable by you as follows:

Initial payment of $_____ on_____

Balance of $_____ in consecutive monthly payments of $_____, commencing_____, and continuing until payments are completed.

Unless I hear from you to the contrary, I shall take it for granted that I have correctly transcribed the arrangements made.

PAYMENT CARD

The payment card can be given to the patient when payment arrangements have been completed and services are started, entry to be made on this card when a payment is made.

Dr._____

Address_____ Phone_____

Patient's name_____ Fee $_____

Date_____ Method of payment $_____

Date	Paid	Balance

ACKNOWLEDGMENT OF PAYMENT RECEIVED THROUGH MAIL

Date_____

Dear_____

I wish to acknowledge with many thanks receipt of your remittance of $_____.

This has been applied to your account, leaving a balance of $_____.

Very truly yours,

CHILDREN'S ANNUAL FEE DENTISTRY

Preventive dentistry has been the keynote of our profession for many years, and especially in recent years. Emphasis has been placed on prevention by the schools and the profession at large. The public is being educated in the necessity for prevention more and more every day.

The individual practitioner has the opportunity for training and educating the children and parents in his practice. From an economic point of view, this problem can be solved by means of a sustaining fee over a period of a year.

If possible, the parent should be encouraged to place the child or children under the dentist's care for the entire year, for an annual fee. This is a wise suggestion if there is more than one child in the family. Generally, the fee for the children at the end of a year is rather high. This may prove a hardship for the average parents if continued year after year, and consequently one child may receive adequate dental treatment, whereas the rest are sent in when emergencies arise.

We can educate the parents in preventive dentistry and the fact that it will minimize the cost of dentistry for the family if the child or children are kept under constant observation and treatment. I call this "children's annual fee dentistry."

There are a number of important considerations in this type of service and contract. The most important factor is the education of the parent in the importance of the care and treatment of their children's teeth.

The parents or guardian should be invited in for a discussion of this subject. They should be told of the findings in the mouth of the child, and if there are two or three children in one family, each mouth should be analyzed.

For example, Mr. and Mrs. Jones have three children, Mary, aged 5; Jane, 10, and Thomas, 13. All three require dental service. Mary, the youngest one, has never visited a dental office. A number

of her first teeth are decayed. In the case of Jane, who is 10 years of age, all the first permanent molars are decayed as well as a number of other teeth. She has had but one tooth filled and has had little dental attention. Thomas, who is 13 years old, has a neglected mouth, about ten teeth being decayed, two requiring extraction. About three teeth have been filled, and if it were not for the fact that the physical training department had insisted on dental treatment as a prerequisite for graduation, this boy would not have been sent to the dentist.

This is a typical middle-class family. What is to be done with this group? They cannot afford to send each individual child in for complete service and pay a separate fee for each one. The total fee for all three would be too great for the parents to undertake, and therefore they have had a little work done where it was absolutely necessary or because of the child's complaint of pain.

If the children visited the office at the early age of 3, we could practice preventive dentistry, since we would be in a position to check any early decay and guide the parents in the oral hygiene of the mouth and acquaint them with the importance of diet.

The children must be divided into three groups: (1) 2-5 years; (2) 6-10 years; (3) 10-15 years. In the first group, the first set of teeth is the primary consideration. The service for this group is the same as for the other groups with the exception that if they are brought in at an early age, there is little restorative work to be done. The annual fee in this group for each child could be a nominal one; whereas in the second group, 6-10 years, the annual fee for each child should be greater, but also nominal in order to allow the parent to pay for this service without any undue hardship. The third group, 10-15 years, would require more attention and more work since we may be dealing with the patient who has had little dental work done.

In all three groups, the requirements must include a full x-ray examination and prophylaxes.

When there are two or three children in one family, one fee can be charged for all, and this could be a total fee for the year.

It is best to have a definite understanding, usually in writing, of the contract. This should be called "children's annual fee dentistry."

"CHILDREN'S ANNUAL FEE DENTISTRY"

In order to maintain the mouth in a healthy condition and to attempt to check further decay, it will be necessary for your (son-daughter)_____ to be under observation and treatment during the entire year.

The services will include (1) prophylaxis; (2) x-ray examination; (3) treatment of teeth; (4) extraction of teeth; (5) restoration of decayed teeth.

The services will exclude (1) major surgery; (2) replacement of missing teeth; (3) orthodontia.

The parents and the patient are to follow all instructions implicitly on home care, and all appointments must be kept.

The annual fee for the above services will be $_____, payable as follows:

This will include the period from_____ 19__ to _____ 19__.

This plan which I present regarding "children's annual fee dentistry" seems to be working out successfully in a number of practices in various cities. If more dentists adopt this plan, it is hoped that we shall be able to care for many more children throughout the country, rendering a worthy service which will be within the reach economically of thousands of families.

CURRENT LITERATURE

Removal of Teeth for Pyorrhea

THE following case history was sent by a physician in Minnesota to the department "Queries and Minor Notes" and published in the May 28, 1938 *Journal of the American Medical Association.*

"The question of the extraction of teeth because of pyorrhea has come up in the case of a young woman. I am unable to advise her because of the conflicting opinions of several dentists whom she has consulted about the matter. She is generally in good health except for a coxalgia, which is somewhat troublesome. The disorder at present is hardly severe enough to warrant the removal of her teeth, unless her present trouble might be considered a forerunner of a more severe type of arthritic disease. The first dentist whom she saw advised extraction of all the upper teeth and the fitting of a denture. He gave the following reasons for his advice: 1. That the treatment of pyorrhea is a protracted affair, with little if any promise of permanent cure, making it more costly than a removable denture, which will be necessary sooner or later in any event. 2. That the depth of the pockets along the gum margin renders it impossible really to get at all of the infection. 3. That to permit the diseased teeth to remain will result eventually in the eroding of the bony processes around the teeth, thus making the fitting of a removable denture more difficult later on. 4. That the teeth are cosmetically not good looking, because they are spaced far apart and are discolored and that for the latter reason a removable, well-fitted denture would be a distinct improvement cosmetically. 5. That there is a certain amount of danger in that these constitute foci of infection even though carefully looked after at regular intervals. Three other dentists insist that she should retain her own teeth as long as possible, that they can be successfully treated and that there will be no danger of absorption of toxic or infective material if they are properly looked after. Since she has limited means, the financial part of the matter enters in. I have seen the x-ray films of the teeth, and the infective process extends half to three fourths of the way along all the roots of the upper teeth. Please give your opinion in this matter."

The editor of the department answers as follows:

"The first dental consultant gives five reasons for his opinion, which, if correctly based on facts, are sufficient to justify his advice. The other three consultants apparently give no reasons other than the statement that the teeth can be retained for a considerable period. This would seem to warrant acceptance of the first consultant's opinion. It is undoubtedly true that dentists often have been inclined to retain teeth as long as possible without sufficient consideration of more remote effects on the health and well-being of the patient. It is also true that physicians have been too ready to condemn teeth and advise extraction without sufficient consideration of the ultimate effect on the patient's denture and health.

"More specifically, it is undoubtedly true that the treatment of such a condition would be protracted and, even if all the diseased tissue could be removed and the supporting tissue restored to a normal healthy condition, its maintenance would require eternal vigilance on the part of the patient and continued assistance on the part of a skilful dentist. The ultimate cost, therefore, would probably be greater than the placing of a denture. The depth of the pockets as indicated by the x-ray films undoubtedly makes it extremely difficult to remove all the infection and obtain restoration to normal in the supporting tissues. This is not, however, impossible. It is undoubtedly true that if the diseased condition of the teeth continues, or if it periodically recurs, there will be a destruction of the alveolar bone that will make the placing of a satisfactory denture much more difficult. A complete cure will, of course, not improve the esthetic appearance

and this may be sufficient reason alone to justify the removal of the teeth and their replacement by a denture. Undoubtedly there is "a certain amount of danger" to the patient's health and well-being if the infection and inflammation are not entirely cured and normal conditions maintained. Considerable emphasis should be placed on this. It is by no means certain, however, that the complete cure of the mouth will relieve the coxalgia. The pyorrhea may be related to this and it may not be."

M. K. HINE.

Osteopetrosis

By F. H. LAMB and R. L. JACKSON

OSTEOPETROSIS or "marble bones" is a rare disease characterized by increase in thickness and density of all bones of the skeletal system, and by profound hematopoietic disturbances. Secondary manifestations are retarded growth, pathologic fractures, optic atrophy, hydrocephalic changes, chronic osteomyelitis and imperfect dentition. The dentition is markedly delayed.

The cause of osteopetrosis is not known although it seems probable that it is due to an inherently abnormal histogenesis; that is, a perversion in mesenchymal development. Methods of treatment are quite futile, although blood transfusions may prolong life.—*Am. J. Clin. Pathol.*, 8:255, 1938.

M. K. HINE.

Swelling of the Gums and Monocytic Leukemia

By L. B. HUME

A CHILD had eight badly carious deciduous molars extracted and about a week later the gums became badly swollen. Their color was about normal. The temperature fluctuated around 103° F. and the cervical glands became swollen. On admission to a hospital, a diagnosis of monocytic leukemia was made. Death occurred one month later. The author believes that the disease was present at the time the teeth were extracted and stresses the fact that this condition could have been easily overlooked. The oral manifestations merely served to cloud the issue and direct the attention to possible postoperative complications instead of to a symptom of some systemic condition. He cites several instances of the same condition which have been reported by others.—*D. J. Australia*, 10:95-96, February 1937.

L. H. GARRISON.

Phosphatase Studies

By H. ROE and E. R. WHITMORE

MANY reports have indicated the relation of increased phosphatase activity of the blood to diseases in which there is new bone formation and to conditions in which the body attempts to lay down new bone. As phosphatase is associated with osteoblastic activity, the determination of phosphatase activity is of especial value in lesions of the bone. The authors review the various technics for the determination of such activity and describe their own in detail. They suggest that the test should be used more often when bone involvement is present.—*Am. J. Clin. Pathol.*, 8:233, 1938.

M. K. HINE.

Lessened Incidence of Caries When Casein Replaces Milk in the Coarse Corn Meal Diet

By C. A. LILLY

HOPPER, Webber and Canniff found that a completely adequate diet of yellow corn meal 60 per cent, whole milk powder 30 per cent, linseed meal 6 per cent, alfalfa meal and sodium chloride 1 per cent produces caries in 100 per cent of the rats tested. With the same diet, the author found that 60 per cent of 200 carefully controlled rats developed dental caries within 100 days. In an attempt to gain further information, fifty-six rats from inbred stock were fed a similar diet, with one modification. Commercial casein was substituted for whole milk powder. After 100 days, it was found that only 10.6 per cent developed caries. From these experiments, it would seem that casein exerts an inhibitory effect.—*Proc. Soc. Exper. Biol. & Med.*, 38:303, April 1938.

S. B. FINN.

Green Teeth Following Icterus Gravis

By R. W. B. ELLIS

GREEN teeth are a rare but recognized sequel of icterus gravis neonatorum as a result of icteric staining of the dental tissues. The author presents the case of a boy aged 2½ years who has twenty totally or partially

green teeth.—*Proc. Roy. Soc. Med.*, 31:766, May 1938.

S. B. Finn.

Analgesia in Dentistry by Means of Nitrous Oxide and Air

By Rex Binning

Although analgesia has been used in dentistry since 1912, it has largely escaped notice in medical circles. It is used in dentistry mainly in the preparation of fillings, being unsatisfactory for the extirpation of nerves or extraction. It is valuable in apprehensive patients, in children and in persons with an idiosyncrasy to procaine. The use of air with nitrous oxide is preferable to oxygen, since it gives a less critical analgesic state. Nitrous oxide must be used at the lowest pressure. The subjective sensations are unobjectionable. A tingling starts in the feet and spreads over the whole body. A pleasant feeling of warmth follows. The speech becomes thick, but the mind is active. The dental drill can be heard, but not felt. The patient is very susceptible to suggestion. There is no nausea nor vomiting. One hundred gallons of nitrous oxide are sufficient for ten fillings and the cost is estimated at 7 pence per filling.—*Lancet*, 234:1050, 1938.

B. G. Bibby.

A Study of Dental Care in Detroit, Michigan

By R. H. Britten

A study was carried out by house to house canvass to determine the extent and nature of dental care received by the general population of a large city. Questions covering the following points were asked: 1. Time of last visit to dentist (exclusive of cleaning). 2. Nature of treatment received during year. 3. Color and occupation of household head and age and sex of the individual. The data received revealed the following interesting points: 1. Thirty-three per cent of the population had visited the dentist during the year. Eleven per cent went only for extractions and 11 per cent for fillings. 2. Negroes visited dentists less than whites did. 3. The difference in age groups that received care varied from 7 per cent at 3-5 years to 31 per cent at 15-19 years down to 6 per cent at 65 years. 4. The number of years lapsing since the last visit to a dentist increased with age from an average of one year at 30 to ten years at 70. 5. Only 5 per cent of age group 25-34 had never been to a dentist. 6. The percentage of persons in the socio-economic groups that visited dentists varied from professional persons 42.5 per cent down to 16 per cent for unskilled workers.—*Pub. Health Rep.*, 53:466, March 1938.

S. B. Finn.

Traumatic Injury of the Condyloid Process of the Mandible

By K. H. Thoma

Including discussions of subluxation, dislocation without fracture, collum fracture and traumatic ankylosis, together with their diagnosis and treatment, the author concludes that injuries to the condyloid process involving the joint capsule, meniscus or both often produce a weakness of the joint that may be associated with audible noise in eating, as well as the more serious conditions resulting from unreduced displacement or ankylosis of the condyle. Injuries to the condyloid process may frequently result from the application of undue force in extracting teeth, or from careless use of the mouth gag under general anesthesia. Since fracture of the condyle is more frequent than is recorded, the author recommends careful x-ray examination from various angles when such an injury is suspected.—*New England J. Med.*, 2:63-71, January 1938.

Frank Allen.

Further Observations Regarding Familial Multilocular Cystic Disease of the Jaws

By W. A. Jones

Multiple dentigerous cysts occurring in three members of a family in both upper and lower jaws and accompanied by a hyperplastic disorder of the submaxillary lymph glands of a chronic nature are described. The disease is bilateral and painless and there is a possibility of swelling. Roentgenograms and photographs reveal abnormal dental development. In the cases cited, there is no evidence of the existence of a like condition in previous generations of the family, on either side. However, in a similar case, the genetic chart shows plainly that the anomaly has been congenital in the family.—*Brit. J. Radiol.*, 11:227, April 1938.

B. J. Frey.

Transplantation of Tooth Germs

By F. Kostecka

In a series of experiments performed on dogs and white mice, the author shows that the transplantation of dental structures of very young embryos results in epithelial cysts and connective tissue. Transplantation of dental tissues from older embryos resulted in the formation of cartilage and, in some cases, of teeth. These teeth were smaller than the natural teeth and did not erupt through the gums. The author observed a normal differentiation, but a very scanty increase, in cellular elements. In one experiment, a typical adenocarcinoma appeared. However, this is not considered as indicating any relationship between carcinoma and implantation of embryonic tissue.—*Verhandlungen d. 11 Klasse d. Tschechisch. Akad.;* abstr. in Ztschr. f. Stomatol.; *per D. Rec.*, 58:210, April 1938.

B. J. Frey.

Chronic Atrophic Arthritis

By H. E. Tompson, B. L. Wyath and R. A. Hicks

Observations on 343 cases of atrophic arthritis show that females are affected more often than males and that the disease is less progressive when treated. The disease was found to be due to focal infection in 57.73 per cent of the patients. In 80 per cent of these cases, the foci were found alone or in combination. The most common focus was found to be the throat, followed by the sinuses, gingival tissue, teeth and respiratory tract. The organism most frequently found was the hemolytic streptococcus. Treatment involves physical therapy, heliotherapy, dietotherapy, climatotherapy, removal of all foci of infection and the use of analgesia, vaccines and anti-anemic drugs.—*Ann. Int. Med.*, 11:1792, April 1938.

B. J. Frey.

Effect of Iron Preparations on the Teeth

By E. Karaila

Children of 8-12 years were given various iron preparations to chew. Although the teeth took on a yellowish brown stain, it was not permanent and disappeared within a week. The teeth of dogs 4 months old were, when decayed, found to absorb the iron preparations. Intact teeth remain unstained, but carious areas become stained when in contact with iron preparations.—*Acta Paediat.*, 21:205, 1937.

S. B. Finn.

Carcinoma of the Palate

By J. R. Nuttall

Certain palatal and upper alveolar malignant lesions involve the antrum more frequently than is generally realized. It is suggested that the tendency to recurrence after treatment of carcinoma of the palate is due to the fact that a large proportion of these "palatal growths" are really neoplasms of the antrum. Intra-oral ulceration is by far the commonest evidence of antral neoplasm, cheek bulging being rare even in late cases. In 167 cases of palatal malignancy, 94 per cent of the lesions of the middle third or alveololabial sulcus involved the antrum. Lesions of the posterior part of the hard palate spread to the soft palate and fauces in only 1.4 per cent of the cases. Diagnostic methods are discussed.—*Brit. M. J.*, 1:839, April 16, 1938.

B. G. Bibby.

Retardation of Growth in Diabetic Children

By J. D. Boyd and A. H. Kantrow

After a review of data on 167 diabetic children observed over a period of ten years in the Pediatric Department of the University of Iowa, the authors selected ten children whose stature or rate of growth over long periods was markedly lower than the standard. The measurements on all but 6 per cent of the group tend to confirm the conclusions that a well-controlled diabetic child may be expected to grow at a rate which equals or exceeds that of superior children. Only two children discussed presented problems of retardation of growth which could not be accounted for in some way. The eight other cases were mostly problems in control of diet.

The authors conclude that if diabetes mellitus is controlled through diet and through avoidance of frequent or continuous glycosuria, retardation of growth will be prevented or corrected and physical retardation should be considered a result of nutritional or allied metabolic inadequacy

rather than a consequence of endocrine disturbances, except in exceptional cases.

It is interesting to correlate these normal growth data with dental findings previously reported from the same laboratory which definitely show retarded or arrested caries in diabetic children who were maintained on a well-controlled diet.—*Am. J. Dis. Child.*, 55:460, March 1938.

VIRGIL D. CHEYNE.

Two Skulls with Absence of the Premaxilla

By D. E. DERRY

THE finding of two skulls showing absence of the premaxilla is of interest because it throws light on the development of this part of the face. Both skulls were those of women. Both were normal with the exception of the absence of the premaxilla. Hitherto, it has been assumed that in man the whole thickness of the part of the alveolar process carrying the incisor teeth and forming the anterior part of the floor of the nose, with the margins of the nares and the nasal spine, is formed from the premaxilla, but these skulls show that the nasal margins and nasal spine may be developed without the premaxilla, being formed from the maxillary processes. A complete description of the skulls is given.—*J. Anat.*, 72, Part II, January 1938.

L. H. GARRISON.

Teeth of the Indians of Pecos Pueblo

By C. T. NELSON

THE author examined 136 complete skulls from the collection at the Peabody Museum of Harvard University, eight without mandibles and twenty-eight odd mandibles. The age in which these Indians lived was estimated at about A.D. 1100. The following tooth measurements were made: (1) mesiodistal and (2) labiolingual diameters of the crown, (3) crown length, (4) root length and (5) total length of tooth. The Pecos teeth proved to be considerably smaller than Australian teeth, and slightly smaller than those of the Bantu, but greatly surpassed in size those of the Bushman and were slightly larger than those of the modern white. The Pecos teeth usually compared favorably in size with those of other U. S. Indians, American Negroes, Melanesians and Eskimos.

In the second part of the paper, the author stated that there was a tendency toward reduction in cusp formula, but this was not so pronounced as that seen in most modern races. There was a tendency toward root fusion and shovel-shaped incisor crowns, with an abnormally high incidence of mesiopalatal torsion of the maxillary central incisors. Half of the skulls were affected by caries, but the number of teeth affected was less than among modern civilized races. Degeneration of the alveolar bone was common. Some degree of attrition occurred, but not enough to cause pulp exposure.—*Am. J. Phys. Anthropol.*, 23:261, January-March, 1938.

GRANT VAN HUYSEN.

Pruritus Gingivae

By L. P. STREAN

PRURITUS has been described as a symptom in various disorders. The term designates "itchiness," and this may be present in many locations, the most common being the anus, vulva, head, arms, legs and between the fingers and toes. The author, in searching the literature, failed to find any records of itchiness of the gums. In this report, he describes five cases and coined the term "pruritus gingivae." He points out the possible connection between the disease and a disturbed sugar metabolism.—*Canad. M. A. J.*, 38:362, April 1938.

EDWARD HAMPP.

General Health at Maturity of Tonsillectomized and Nontonsillectomized Children

By M. C. HARDY

A STUDY of 521 normal persons representing a wide range in economic conditions and examined at different periods of their life up to the age of 21 years and including a control group of 106 young people who had no previous contact with the health plan reveals some startling observations:

1. Results of removal of tonsils are not always beneficial.

2. Removal of tonsils did not appear to prevent various ailments and physical defects.

3. Tonsillectomized children were fre-

quently in less satisfactory physical condition at maturity in many respects than the control group.

4. The age at which the tonsils were removed seemed to have little effect on general health in late childhood.

5. Children repeatedly advised to have tonsils out were in less satisfactory condition than those operated on.

The results tended to corroborate another writer's work (Kaiser) in that healthy mouths were more frequent and the incidence of caries lower in the tonsillectomized group. The two authors do not conclude, however, that infection of the tonsils is a cause of caries, because they found dental infection as pronounced in young people whose tonsils were free from clinical symptoms as in those with infected tonsils.

There is little in the author's conclusions which would warrant removal of tonsils except in those cases wherein persistent infection is apparent and the patient is repeatedly advised to have them removed.—*J. Pediat.*, 12:463, April 1938.

VIRGIL D. CHEYNE.

Aging of the Skull

By M. F. ASHLEY-MONTAGU

THIS article contains an excellent account of the papers published on the problem of aging of the human skull. From these accounts, it appears that the only usable guides for the estimation of skull age have been the state of suture closure and the state of the dentition; that is, its period of eruption. The author looks to the future for more adequate standards as to the normal skull, with perhaps the utilization of a new skull age guide such as a combination of tooth abrasion and suture closure.—*Am. J. Phys. Anthropol.*, 23:355, January-March, 1938.

GRANT VAN HUYSEN.

Rôle of the Hypophysis in Cranial Osteomyelitis, Petrositis and Sinus Infection

By G. LEVENE, L. F. JOHNSON, R. M. LOWMAN and E. G. WISSING

BY means of roentgenologic examination of more than 3,000 skulls, the authors found that the bony texture of the skull is directly influenced by the activity of the anterior lobe of the hypophysis. They find that the changes may be classified into four groups or types, two being due to overactivity of the anterior lobe and two to underactivity. In hyperfunction, a trabecular expansion occurs with an increase in blood supply and a thinning of the inner and outer tables of the bone. It is in this condition that cranial osteomyelitis and sinus infection most frequently occur. In anterior lobe deficiency, an absence of diploic expansion results in a hard, dense bone with the inner and outer tables in close approximation. Characteristic of this condition are lessened vascularity, reduction in size of face and jaws and delayed dentition. The spread of an infectious process, such as osteomyelitis, occurs readily in a bone of less dense architecture and increased vascularity.—*Endocrinology*, 22:521, 1938.

FRANK ALLEN.

BIBLIOGRAPHICAL

BOOK REVIEW

"Periodontia"

By Warren Page Willman, D.D.S., M.S., Assistant Professor of Operative Dentistry and formerly head of the Clinical Division of Periodontia, Chicago College of Dental Surgery, School of Dentistry, Loyola University, Chicago. Pp. 315. 117 illustrations. Index. A volume in the series of *National Dental Monographs*, edited by C. N. Johnson, M.A., D.D.S., LL.D. New York: National Medical Book Company, Ltd. Price $3.00. 1938.

The biologic approach to dental problems is one that seems to have a good deal of approval, but one, strangely enough, that few authors seem willing, or able, to make use of in a thorough-going investigation of their subjects. Dr. Willman, in this textbook on periodontia, not only accepts this approach, but also uses it as the ground-plan for the entire book. The result is that it is one of the very few books on the subject that does more than pretend to treat adequately the histology and pathology of the tissues involved. The chapters that deal with the normal structure and biology of the periodontium and with the pathology and dysfunction of the periodontium are admirable for their clarity of style and completeness of content.

In approaching his problem from the biologic angle, the author has not made the mistake of losing himself, and his readers, in a complexity of theories. This intensely practical book finds such eminently useful things as instrument selection, finger position and technic of instrumentation within its scope. In fact, this text will serve capably as a laboratory manual in the practice of periodontia for both student and practitioner.

After a discussion of the histology and pathology involved, the author sets forth the clinical manifestations of periodontal diseases. This chapter is given added distinction and value because there is careful differentiation between the problems presented by varying age groups, a factor that is too often casually dismissed. The chapter on the treatment of periodontal diseases is complete and practical. There is also no reluctance on the part of the author to speak out on treatments that have compiled meager or dubious records of success.

Other important phases of periodontal treatment are discussed. There is a chapter on the surgical elimination of the periodontal pocket and some attention is given to a careful review of the facts with regard to the use of electrocoagulation. The volume concludes with a discussion of Vincent's infection, the periodontal pocket as a potential focus of infection, prophylaxis and oral hygiene.

The reviewer cannot let this opportunity pass to say a few words about the excellent illustrations that are used to supplement the text. There are more than a hundred of them and each is a fine example of what the scientific photograph or illustration should be but so often is not. A very competent job has been done by the publishers in getting so many illustrations into a text that is priced as low as this one.

Dr. Willman's style is refreshing. He does not hesitate to make his scientific facts more attractive and vivid by using graphic parallels or illustrations. His criticisms are pointed and his exposition is occasionally touched with wit. This readable, practical text sets a very high standard for the other books in the field. It is not too much to say that this text could well be imitated to advantage by authors who have something to say about the science and art of dentistry.

Harold Hillenbrand.

"The Treatment of Clinical and Laboratory Data. An Introduction to Statistical Ideas and Methods for Medical and Dental Workers"

By Donald Mainland, M.B., Ch.B., D.Sc. (Edin.), Professor of Anatomy, Dalhousie University, Halifax, Nova Scotia, Canada. With 23 text figures.

Oliver and Boyd, Edinburgh: Tweeddale Court; London: 33 Paternoster Row, E. C., 1938. Price 15 shillings, net.

After an extensive experience in collating and evaluating varied types of clinical data, the author was particularly impressed with the desirability of devising a logical method of allowance for chance of error or variation in evaluating clinical data originating in varied quantities and from varied sources. And in the present volume he has endeavored to present in a logical and understandable manner the method he has devised. At a time in dentistry when many clinical data are being collected, particularly clinical observations that will undoubtedly shed light on the problem of dental caries, it is quite desirable that a method such as the author presents be made available to statisticians and research workers. The fact that these data are being derived from varied and sundry sources and from men with varied conceptions of the use or usefulness of the data makes such a method of evaluation as that proposed by Mr. Mainland particularly timely.

The book should be most helpful and suggestive in every field of active dental research. It is printed in clean-cut large type and is singularly free of errors in a field where there is large opportunity for this unfortunate and frequent attendant feature of statistical records.

"Surgical Diseases of the Mouth and Jaws"

By Earl Calvin Padgett, B.S., M.D., F.A.C.S., Associate Professor of Clinical Surgery, University of Kansas School of Medicine, Kansas City, Kans.; Associate Professor of Oral Surgery, Kansas City-Western Dental College, Kansas City, Mo. 807 pages with 334 illustrations. Philadelphia and London: W. B. Saunders Company, 1938. Price $10.

This book on surgery of the mouth and jaws constitutes a notable contribution to the oral surgery literature by one who has had long experience in teaching the subject to dental students.

The author, in a very comprehensive manner, indicates and covers the scope of the oral surgeon, answering fairly well the perennial question as to the limitations of the field of oral surgery. If the oral surgeon can capably compass the field as here delineated, he will have ample scope for his special activities.

The author has given particular attention to the anatomy of the mouth, jaws and teeth and presents this phase of his subject in a manner most helpful to the dental student.

The illustrations amplifying the technical procedures of operation are quite clear and exceptionally well done. Each chapter is supplemented by a bibliography that is a most helpful guide to further study of the various phases of oral surgery.

The bookmaking is another example of the high standard of this well-known publisher of medical and dental textbooks.

"A Textbook of Exodontia: Exodontia, Oral Surgery and Anesthesia"

By Leo Winter, M.D., D.D.S., Sc.D. (Hon.), LL.D., Professor of Oral Surgery and Director of the Oral and Minor Surgery Clinic, New York University College of Dentistry; Visiting Dental Surgeon in Charge, Bellevue Hospital; Etc. Third revised edition. St. Louis: The C. V. Mosby Company, 1937. Price $10.

With this, the third edition of his textbook on exodontia, the author appropriately elaborates the pharmacology of the various local anesthetics and describes in detail the technic for the use of each one. The technic of making the various injections is fully presented with illustrations that leave practically nothing to the imagination. Dr. Winter gives in minutiae the technic of extraction from the simplest extraction to that of a complicated case of surgical removal of the impacted third molar. Particularly well illustrated and described is the surgical procedure for preparation of the jaws for denture prosthesis. Altogether, there are 450 illustrations, which amplify the text in a most helpful manner.

The author says that the present era of oral surgery will be recorded in history as the anesthetic era; that is, the era in which definite and distinct advance has been made in the discovery and improvement of the anesthetic agents and their administration. This book by Dr. Winter constitutes a notable contribution to the recording and describing of the various drugs and their administration. The illustrations are particularly well done and the book-making is of a high standard.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

American Dental Association, St. Louis, Mo., October 24-28.

American Academy of Restorative Dentistry, St. Louis, Mo., October 22-23.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

American Society of Orthodontists, Los Angeles, Calif., July 11-14.

American Society of Oral Surgeons and Exodontists, St. Louis, Mo., October 21-22.

American Association of Public Health Dentists, St. Louis, Mo., October 23-24.

American Society for the Promotion of Dentistry for Children, St. Louis, Mo., October 24.

American Academy of Periodontology, St. Louis, Mo., October 20-22.

Association of American Women Dentists, St. Louis, Mo., October 24-28.

Fédération Dentaire Internationale, Paris, July 21-26.

Great Lakes Association of Orthodontists, Cleveland, Ohio, November 7-8.

Pacific Coast Dental Conference, Vancouver, B. C., July 4-8.

Greater New York Dental Meeting, New York City, December 5-9.

District of Columbia Dental Society, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

American Dental Society of Europe, Stockholm, August 1-3.

Montreal Dental Club Clinic, at Montreal, Canada, October 12-14.

ARPA Internationale, Prague, Czechoslovakia, August 26-28.

American Dental Hygienists' Association, St. Louis, Mo., October 24-28.

American Dental Assistants Association, St. Louis, Mo., October 24-28.

STATE SOCIETIES

September

Southern California, at Coronado Beach (12-14)

November

Ohio, at Cleveland

Florida, at Jacksonville (10-12)

STATE BOARDS OF DENTAL EXAMINERS

Arizona, at Phoenix, July 18. R. A. McCall, 719 Professional Bldg., Phoenix, Secretary.

Delaware, at Wilmington, July 6-8. Charles R. Jefferis, 409 Medical Arts Bldg., Wilmington, Secretary.

Idaho, August 2-5. J. L. Balderston, Boise, Commissioner.

Montana, at Helena, July 11. Leonard A. Jenkin, 401 Ford Bldg., Great Falls, Secretary.

New Jersey, June 27-July 2. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

New York, September 19-22. Minor J. Terry, Education Bldg., Albany, Secretary.

North Dakota, at Fargo, July 11-14. W. E. Cole, Bismarck, Secretary.

AMERICAN SOCIETY FOR THE PROMOTION OF DENTISTRY FOR CHILDREN

The next annual meeting of the American Society for the Promotion of Dentistry for Children will be held at the Jefferson Hotel, St. Louis, Mo., October 24.

RALPH L. IRELAND, *Secretary,*
University of Nebraska
College of Dentistry,
Lincoln, Nebr.

AMERICAN ACADEMY OF PERIODONTOLOGY

The twenty-fifth (silver) anniversary of

the American Academy of Periodontology will be held at the Coronado Hotel, St. Louis, Mo., October 20-22. Members of the American Dental Association interested in periodontia are invited.

RAYMOND E. JOHNSON, *Secretary,*
824 Lowry Medical Arts Bldg.,
St. Paul, Minn.

ASSOCIATION OF AMERICAN WOMEN DENTISTS

The seventeenth annual meeting of the Association of American Women Dentists will be held in St. Louis, Mo., October 24-28.

NATALIE E. MCDONALD,
151 Engle St.,
Englewood, N. J.

DENTAL INTERNSHIP

Senior students of the class of 1939 who contemplate accepting a resident dental internship with full maintenance in a large general hospital for a year of postgraduate work in the surgical branches of dentistry may apply at this time for an application form. Examinations will be held during Christmas week of 1938 for internship commencing July 1, 1939, at Lincoln Hospital, a unit of the Department of Hospitals of the City of New York.

M. HILLEL FELDMAN, *Director,*
Dental Department,
730 Fifth Ave.,
New York City.

BOARD OF DENTAL EXAMINERS OF THE STATE OF CALIFORNIA

The address of the Board of Dental Examiners of the State of California has been changed to Room 203, 515 Van Ness Ave., San Francisco.

KENNETH I. NESBITT, *Secretary,*
450 Sutter St.,
San Francisco.

EXAMINATION FOR APPOINTMENT IN DENTAL CORPS, REGULAR ARMY

An examination for selection of candidates for appointment in the Dental Corps, Regular Army will be held August 15-20 inclusive, at the Walter Reed General Hospital, Washington, D. C.; Fitzsimmons General Hospital, Denver, Colo.; Letterman General Hospital, San Francisco, Calif., and Fort Sam Houston, Texas. The general eligibility requirements for appointment are that the candidate be a citizen of the United States between the ages of 23 and 32 years, be a graduate of an acceptable dental school and be physically fit. Candidates must also have been engaged in the practice of their profession for at least two years subsequent to graduation. Application for authority to take the preliminary examination must be made on the form provided for the purpose, which may be obtained at any military post or station or from the Adjutant General of the Army, Washington, D. C. A circular of information concerning the Dental Corps, scope of the examination and method of making application may be obtained from the Surgeon General, U. S. Army, Washington, D. C. Applications will be received for consideration until August 1, 1938.

INTERNATIONAL DENTAL FEDERATION

As the tragic death of our beloved honorary president, Georges Villain, makes it inappropriate to follow out the original program arranged by the French National Committee, it has been decided to hold merely a business meeting and to devote July 21 to a commemorative session in honor of the memory of Dr. Villain. July 22, at 11:30 a.m., the members will assemble at the Cemetery Montparnasse (Bld. Edgar Quinet, main entrance) to place a tribute of flowers on the tomb of Dr. Villain.

According to the resolution adopted in Stockholm, there will be a joint meeting of several commissions July 25 at which papers will be read. All members of the F. D. I. will be welcome.

As Paris is crowded at this time of the year, it is suggested that hotel reservations be made at once. Address Mr. Wallis-Davy, 45 Rue de la Tour d'Auvergne, Paris IX.

CHARLES F. L. NORD, *Secretary General,*
1 Oude Scheveningscheweg,
The Hague, Netherlands.

AMERICAN CONGRESS OF PHYSICAL THERAPY

The seventeenth annual scientific and clinical session of the American Congress of Physical Therapy will be held cooperatively with the twenty-second annual convention of

the American Occupational Therapy Association, September 12-15, at the Palmer House, Chicago. Before these sessions, the congress will conduct an intensive instruction seminar in physical therapy for physicians and technicians, September 7-10.

A. R. HOLLENDER,
Executive Director,
30 North Michigan Ave.,
Chicago, Ill.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING APRIL AND MAY 1938

April 5

No. 2,113,223, to SODY SALABES. Method of making dental trays.

No. 2,113,439, to LOUIS WILNER. Dental device.

No. 2,113,460, to EDWARD L. CHOTT. Dispenser.

April 12

No. 2,113,568, to GEORGE R. ANDRUSS. Food directing pressure relieving tooth assembly.

No. 2,114,149, to IRVING PENSKY. Handle for toothbrushes.

April 19

No. Re. 20,704, to ALPHONSE F. PIEPER. Dental syringe.

No. 2,114,872, to BENJAMIN F. CONNER. Cotton dispensing container.

No. 2,114,947, to PHILIP WARSAW. Toothbrush.

April 26

No. 2,115,116 to HENRY F. MCGRANE. Artificial tooth.

No. D-109,393, to ELEANOR W. DODD. Design for an educational model.

May 3

No. 2,115,731, to MATTHEW LOZIER and CLAYTON H. FROST. Multiple compartment ampule and hypodermic syringe.

No. 2,115,939, to ARTHUR H. BROWN. Suction valve for dentures.

No. D-109,472, to HARRY CLARREN. Design for toothbrush.

No. D-109-497, to JOHN H. MORCOM. Design for dental floss holder.

May 10

No. 2,117,086, to JOHN G. FEMINELLA. Dental flask.

No. 2,117,174, to JAMES M. JONES. Toothbrush.

No. D-109,631, to HARRY WEISS. Design for a display dental model.

May 17

No. 2,117,469, to ROLLIN T. WOODYATT. Injection instrument.

No. 2,117,666, to RAYMOND L. HUGHES. Impression tray.

No. 2,117,844, to ROCCO F. GRIECO. Dental instrument.

No. 2,117,846, to LOUIS KALVIN. Dental Impression tray and holder.

May 24

No. 2,118,221, to FELIX C. MONTUORI. Hypodermic syringe.

No. 2,118,555, to JAMES FRANKLIN GIFFEN. Denture construction.

May 31

No. 2,118,934, to RUDOLF MADZAR. Artificial tooth.

No. 2,118,980, to HOWARD H. MONTGOMERY and ALPHONSE J. BOURGEOIS. Dental impression tray.

No. 2,119,047, to CYRIL J. GAIL. Dental cabinet.

No. 2,119,446, to JUSTIN G. SHOLES. Self-administering of gaseous anesthetics.

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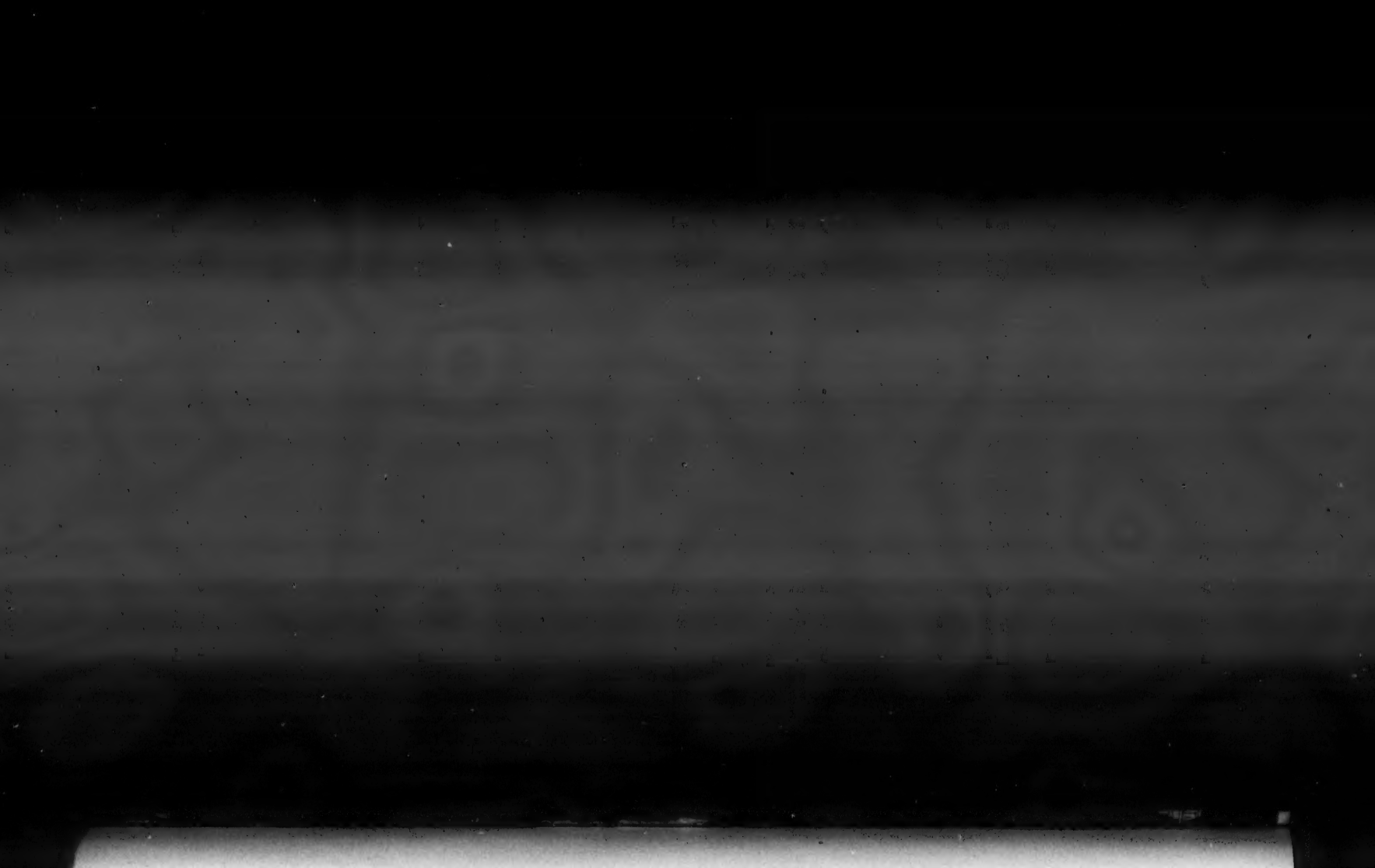
*Deceased.